



**Town of Grafton, Massachusetts Fire Department**  
**Fire Apparatus Fleet Review and Assessment**



# **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

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## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

### **1.0 Overview:**

*The Town of Grafton, Massachusetts through the request of Town Administrator Timothy McInerney retained the services of Emergency Vehicle Response for the purpose of analyzing the apparatus and vehicle fleet, equipment and maintenance practices of the Grafton Fire Department. The scope of services were crafted to provide Town officials and fire department leadership with a long range plan for fire apparatus replacement as well as the appropriate units to best serve the community. The fleet study was specifically designed to develop replacement strategies, financial planning and an improvement plan to insure safe operation of department apparatus and to provide recommendations to enhance fire protection within the Town of Grafton served by the fire departments three stations. This report presents the results of a comprehensive review of the management and maintenance practices of the Grafton Fire Department vehicle fleet with quantitative data when available to substantiate the recommendations and findings within this report.*

*While the Grafton Fire Department has in the past maintained an adequate number of apparatus the organization has struggled to provide needed apparatus based upon the recommended life cycle for engines, trucks and special service vehicles. Past practices have been to replace front line apparatus after twenty five years of service, however due to many factors the average age of units at the time of replacement has been 28.87 years, resulting in increased operational and maintenance costs. Since 2000 the fire department has been able to acquire six new pieces of apparatus together with one, used engine to bolster the departments aging fleet. In addition, several of the support units including Tanker 1, and both Forestry 1 and 3 are severely overloaded and when combined with their age and condition are a serious liability to the department.*

*The fire departments current front line apparatus fleet consists of thirteen vehicles which average 20.9 years of age, having been built between 1966 and 2016. The average age of the fleet outside of the used apparatus acquired by the Town through the Massachusetts Division of Forestry is slightly improved at 14 years old. Since 1958 the department acquired a new apparatus approximately every three and a half years with the vehicle fleet increasing in size with a combination of new, used and transferred vehicle assets. With several units being overweight and the department's engine company units averaging over twenty years old, the overall size and mission readiness of the vehicle fleet needs to be addressed.*

*During July, 2016 the staff of Emergency Vehicle Response performed several days of field work and analysis to gather information and review available records on the apparatus, equipment and maintenance practices. Departmental maintenance and testing records for the past several years together with onsite inspections of each individual apparatus at the respective fire stations were conducted to gain information on the department's programs, policies and response patterns to alarms. With the assistance of Assistant Chief Stephen Charest apparatus records including original specifications, maintenance and testing data and apparatus responses were summarized for analysis and review.*

*Emergency Vehicle Response personnel also conducted an overall review of the land area, development and structural conditions within the Towns of Grafton in all areas including the portions of the town that*

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*are beyond protection from fire hydrants, in order to identify the apparatus and equipment requirements that would provide the necessary resources for the area. Each piece of apparatus was thoroughly examined and evaluated with respect to operational capabilities, physical and mechanical condition as well as maintenance and repair history.*

*This information was utilized to evaluate the suitability of the present apparatus fleet for the missions that the Grafton Fire Department and personnel would be expected to perform during an emergency incident within the response areas. The department's three fire stations are strategically located to protect the areas of the community while relying upon call personnel to staff and operate the apparatus. There are several residential and commercial occupancies that are in the planning stages as well as a significant target hazard of an LPG transfer facility at the Grafton and Upton Railroad facility on Westboro Road.*

### **2.0 Executive Summary:**

*The Grafton Fire Department's fleet of eight front line and five support vehicles is made up of an aging group of apparatus, particularly with respect to the engine, tanker and forestry units. The department has traditionally operated with three vehicles each assigned to Station 2 in North Grafton and Station 3 in South Grafton. The size of the apparatus bays at these locations, particularly at Station 2 has limitations which restricts the height and length of replacement vehicles. When the new headquarters station was completed during 2008, the department now had adequate floor space to store apparatus. With the exception of the 2012 Pierce Saber, Engine 2 the engine fleet is not well designed due to vehicle age, lack of equipment standardization and maintenance costs. The acquisition of Tower 1 equipped with a 95 foot mid-mount aerial platform and 115 feet of ground ladders, replacing a 36 year old vehicle lacks sufficient portable ladders and truck company equipment.*

*During the month of July, 2016 Emergency Vehicle Response conducted field work, when each piece of fire apparatus were weighed, it confirmed that Tanker 1 and Forestry 1 were both overloaded on either the front or rear axles and no immediate action could be taken to alleviate these conditions without removing equipment or a reduction in water tank size which in either case would render the apparatus unsuitable for emergency service use. As these two vehicles are both forty one years of age they are beyond their useful life expectancy and are unsafe to operate on public highways.*

*Forestry 3, which is housed at the South Grafton fire station was out of service at the time of the field survey due to inoperative brakes and therefore the in-service weight of this vehicle could not be determined. As this apparatus is 50 years old with replacement parts being difficult to acquire no funds should be expensed to repair this vehicle. Specific recommendations for the replacement of Forestry 1 and Forestry 3 are noted in Section 5.39 of this report.*

*The National Fire Protection Association Standard 1901 establishes the minimum requirements for motorized fire apparatus and within this document it recommends a maximum front line service period of fifteen years, with creditable apparatus serving an additional five years of reserve service. Applying this*

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*criteria to the current Grafton Fire Department vehicle fleet only six of the thirteen units meet this standard. Vehicle life cycle costs can be broken down into three distinct categories: Service Life is the amount of time the vehicle could render service to the community; Technological Life, considers obsolescence compared to a new vehicle built using the latest technology in manufacturing, safety and operational aspects; and most importantly the Economic Life; as being what impact that vehicle maintenance and testing has on the department's capital and operating budgets.*

*The impact of past vehicle acquisitions has resulted in a fleet that exhibits safety concerns to the fire personnel that operate the apparatus as well as potential liabilities to the Grafton Fire Department. The department currently has very limited ground ladder capabilities beyond the equipment carried on Tower 1 and the 28 foot extension ladders carried on Engine's 1 and 3. With the multitude of townhouses, condominiums, apartments and large area single family residential properties there are any number of locations where the current department ground ladder equipment are not capable of protecting these structure's. The Grafton Fire Department in conjunction with the Town officials need to address the fleet replacement issues following the recommendations included within this report.*

*During the review of the department's vehicle fleet and maintenance records, several areas were identified where the organizations planning and performance is in line with best practices in providing the needed fire protection resources as follows:*

- Since 2001 the fire department has acquired new apparatus from well-respected and competent manufacturers which should provide the needed life cycle service to meet the objectives of the fleet replacement program.*
- Engines are equipped with 2.00 inch hose for attack lines and 4.00 inch supply line hose with four way hydrant valves to take advantage of the municipal water supply fire flows.*
- Several units were built with stainless steel bodies which should improve the opportunities to rebuild and extend their life cycle service in order to balance out the fleet replacement program.*

### **2.1 Key Observations:**

*Several issues have been identified in this report which will require appropriate technical and financial planning by the respective Town officials in conjunction with the chief officers of the Grafton Fire Department to insure that the present level of emergency response capabilities will be maintained in the future.*

- 1. The Grafton Fire Department has no formal replacement plan for fire apparatus which has led to a situation where fire apparatus is operated well beyond its intended life cycle with units that do not meet National Fire Protection Standards that have been in place for a number of years. The lack of a formal fleet replacement cycle has manifested itself where several apparatus have*

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*experienced extensive repairs in an attempt to extend their life cycle. Engine 4, a 1982 Ford Pierce engine was acquired as a used vehicle in 2011 to fill a gap when the former Engine 2 experienced major component failure. This vehicle has required approximately \$23,263 dollars in repairs and maintenance over the past three years to serve as a back-up, reserve engine for the department.*

- 2. Several of the units in the fleet including Tanker 1 and Forestry 1 are overweight on the front or rear axle as these units were acquired from government surplus and rebuilt into wildland and tanker vehicles. Other vehicles are showing signs of premature rust and corrosion at various points on the apparatus with many units operating with over age tires that are original when the apparatus was initially placed into service. The in service condition for these units as noted during the vehicle inspections were poor as will be documented within the report. Future apparatus should be specified with finish painted frame rails and body sub-structure with anti-corrosion treatments provided for these critical components. The continued use of aluminum or stainless steel bodywork and sub-frame material can enhance the life cycle of the apparatus and reduce overall maintenance costs with proper apparatus design and construction.*
- 3. The current condition of the vehicle fleet is a concern with an overall age of 20.9 years with the five engine apparatus averaging over twenty years. The past history of vehicle purchases were partially driven by having each fire station assigned two pieces of apparatus that could operate as initial response units. This resulted in the purchase of Engine 10, which normally operates at wildland incidents in 1990 and Engine 4 acquired used from New Castle, New Hampshire in 2011 for use as reserve engines. Tower 1 was designed as a quint with a pump, water tank and hose bed which limited the available space to carry ground ladders and related truck company equipment.*
- 4. The type of ladder company apparatus historically operated by the Grafton Fire Department has included a 100 foot American LaFrance midship aerial ladder along with the current 95 foot aerial platform unit that was acquired during 2001. Due to the design and complexity of platform units, these vehicles when compared to aerial ladders require more extensive maintenance and training in order to keep the apparatus in serviceable condition. While this vehicle may have been an attractive purchase for the department, records reviewed to determine repair and maintenance costs have exceeded \$27,000 dollars over the past two years which does not include any required certification testing which has not been conducted for some time.*

*The building and structural conditions in the response district require a minimum of a 95 to 100 foot aerial device with an extensive complement of ground ladders as identified in Section 5.20 of this report. While Engine 1 and Engine 3 each are equipped with a two section, 28 foot extension ladder there are numerous single and multi-family structures that would require additional elevated and portable ladder equipment, beyond the current capabilities of department units.*



5. *The fire department has operated a former US Air Force refueler vehicle as a tanker to support rural water supply operations in the areas of the Town that are beyond protection from fire hydrants. This vehicle was built in 1975 and designed to carry 5000 gallons of jet fuel which typically weighs 6.84 pounds per gallon, compared to water weight of 8.34 pounds per gallon. Tanker 1 now carries approximately 4200 gallons of water in a partially baffled tank and when combined with the minimal amount of equipment and hose the vehicle is almost 2000 pounds overloaded, in excess of the chassis gross vehicle weight rating without personnel. Due to the age, condition and weight issues with this apparatus, Emergency Vehicle Response recommends that this vehicle immediately be removed from service and not used for fire suppression or public service use. Recommendations for the replacement of this tanker, which would be a designed as a multi-purpose engine/tanker to replace several older units in the fleet are detailed in Section 8.1. This engine/tanker should be the first unit to be acquired with the recommendations of the fleet replacement program.*

### **3.0 Grafton Fire Department Demographics:**

*The Grafton Fire Department was first organized as a volunteer fire company dating back to 1852 with a second fire company in North Grafton organized as the Henry Crippen Hose Company in 1888. The headquarters fire station is located at 26 Upton Street and houses seven units including Engine's 1 and 4, Tower 1, Tanker 1, Forestry 1 and 2 along with Utility 2 along with an ambulance operated by Med Star. Station 2 is located in North Grafton at 2 Mill Street and houses Engine 2, Truck 6, an air/light utility unit and Truck 10, a forestry unit and back up engine. This station has very limited apparatus floor space with two units parked in tandem in a 60 foot long bay with ten foot doors. The current vehicles barely fit into the available space and would limit any future new apparatus built for this station. Station 3 is located at 92 Main Street in South Grafton and accommodates four vehicles including Engine and Forestry 3, Rescue 1 and the department's canteen/support unit.*

*Since 2012 the department has responded to an average of 457 responses each year. During this period the total number of incident responses has increased 38.9 percent with the greatest changes in the number of automatic alarms resulting in system malfunctions and smoke investigations. These type of good intent calls and false alarms tend to reduce staffing levels and put a further demand on the readiness of the vehicle fleet which is reflected in the current condition of the apparatus. At this time the department does not track the individual unit responses to incidents, due to lack of time for administrative personnel to input this data into the computer system.*

*The Town of Grafton is serviced by two water systems, the Grafton Water District covers the central and northern portion of the town with the South Grafton Water District providing water in the southern portion of the town. Areas within each water district have fire hydrants with the other*



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outlying areas are reliant upon rural water supply using on board booster tanks and outside aid tankers. The fire department is charged a service rental fee of \$150 dollars per hydrant by each water district.

Portions of the water services are being extended to cover some of the built up, residential areas in the community, however a significant portion of the town is reliant upon tanker apparatus and rural water supply shuttles to provide fire protection for these areas. With the age and condition of the department's current tanker, this unit needs to be removed from service and replaced with a vehicle in accordance with the recommendations outlined in this report in Section 8.1.

During May, 2012 the Insurance Services Office (ISO) completed a review of the Town's fire protection facilities including fire flow tests of the water system at eleven locations. The results of the flow testing indicate a robust water supply with available flows at 20 PSI residual pressure ranging from 7500 gpm along Magill Drive to 850 gpm at Westboro road and Wildlife Drive.

The average fire flow available from the locations tested by ISO was 3600 gpm at 20 PSI with four locations producing more than 4500 gpm. The fire department has outfitted each engine company with 1000 feet of 4.00 inch supply line and four way hydrant valve for fire suppression water flow delivery. The Town of Grafton is fortunate to have a strong water supply and due to the oversight of the Fire Prevention Bureau and Planning Department, emphasis has been placed on reviewing building sites with respect to fire department access, hydrant and fire protection system connections.

One of the few independent reviews of fire protection capabilities is provided by the Insurance Services Offices (ISO), a not for profit company that serves the insurance industry in most states in both fire and causality areas. The ISO Fire Suppression Rating Schedule analyzes a communities fire protection levels for the purpose of establishing base fire insurance rates for commercial and residential properties. In order to receive credit for the fire department that is contractually obligated to provide fire protection a commercial building must be within three miles road distance of the nearest fire station and residential homes must be within five miles of the fire station. The fire department resources in the areas of station locations, staffing, training, engine and ladder company apparatus and equipment are evaluated with respect to the community building hazards along with the appropriate National Fire Protection Association Standards in several areas. During the most recent ISO survey in 2012 the Town of Grafton graded as Class 4/9 with apparatus requirements of three engine companies and one ladder truck. During this review ISO awarded points of credit as follows:

<b><u>Fire Suppression Rating Area</u></b>	<b><u>Earned Credit</u></b>	<b><u>Credit Available</u></b>
Receiving and Handling Alarms	6.50	10.00

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Fire Department	28.25	50.00
Water Supply	36.62	40.00

*ISO does not review and consider structural conditions in the areas of the Town that are beyond recognized water supplied with fire hydrants. There is available credit for rural water supply operations based upon the availability of tankers and large diameter hose relays where the fire department can demonstrate their ability to provide a minimum fire flow of 250 gpm for a duration of two hours. In order for the Grafton Fire Department to train and operate in this manner a combination of a new engine/tanker apparatus together with automatic aid from the Upton Fire Department and other adjacent departments that operate tankers or large diameter carrying units could provide a reduction in fire insurance premiums for property owners in these areas.*

### **4.0 Fire Apparatus Fleet Analysis:**

*The Grafton Fire Department operates a total of thirteen pieces of fire/rescue apparatus, including five engines, one midship mount tower, one heavy rescue, an air/light unit, one tanker, two heavy forestry units along with a smaller pick up forestry unit and utility truck. This report will address each major piece of apparatus, its design, frequency of use, mechanical condition, equipment and hose deployment capabilities together with a recommended time frame when the unit should be replaced in the future.*

*All front line engine, ladder, and squad apparatus are equipped with four door enclosed cabs with the exception of Engine/Forestry 10 which is provided with a two person cab and Engine 4 which is a two person cab with a rear facing bench seat in an open canopy. Four door, enclosed cabs have been required by the National Fire Protection Association 1901 Standard since 1991, so for practical purposes, Engines 4 and 10 are not compliant and due to their age, condition and extensive maintenance costs should be removed from the fleet as soon as practical, following the recommendations noted in Section 6.0.*

*Also of concern is the age, condition and overweight issues on Tanker 1 and Forestry 1, both located at the main fire station. Both of the heavy brush units and the tanker were acquired from different federal property excess programs and while the design and function of the tanker needs to be improved with a new, combination vehicle that can operate as both an engine company and rural water supply unit the heavy brush units could be replaced with similar, but newer government surplus vehicles and locally outfitted to meet the needs of the fire department at a nominal cost. Section 5.39 of this report will address the recommendations for the forestry units.*

*Replacement strategies for fire apparatus can be based upon several factors including age, maintenance costs, need to change or update equipment as well as the number of runs and associated road mileage/engine hours on each vehicle. Fire apparatus is generally replaced after fifteen years of first line service and may be utilized as a reserve or spare unit for an additional three to five years, depending upon age, use, condition, initial specifications and adaptability to the department's current operating*

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*procedures. The National Fire Protection Association which is responsible for developing the standards for fire apparatus revises and updates the 1901 Fire Apparatus Standard every five years in order to keep pace with technology and the component manufactures in these areas.*

*Recent changes in engine exhaust emissions requirements by the federal Environmental Protection Agency during 2007 and 2010 have had dramatic impacts on the fire apparatus industry with respect to cab designs, engine cooling and exhaust system components. Future EPA requirements planned to take effect in 2021 to improve fuel economy and greenhouse gas emission will again have an impact on engine technology, cab designs and vehicle costs.*

*These mandated emissions requirements together with the most recent changes in the NFPA 1901 Standard in 2009 and 2016 have caused significant annual increases in the cost of all major types of fire apparatus. Based upon the department current fleet, adopting a twenty year life cycle for all vehicles would require that one new unit would have to be placed into service every one and a half years. This replacement cycle is unrealistic considering the replacement cost of each unit and the life cycle costs for an engine when compared to a lesser used wildland/forestry unit.*

*While ISO only requires engine and aerial devices for the purposes of their evaluation, from a practical standpoint fire departments are responsible for other varied incidents including vehicle accidents, technical rescues, wildland fires and calls for service in rural areas beyond protection from fire hydrants. A more pragmatic approach is to review the level of overall incident responses and when available, individual vehicle utilization at these incidents, balanced with staffing levels on each vehicle. For example, a response of two personnel on a wildland/forestry unit may be reasonable as other resources would be responding from stations in Grafton or neighboring communities. That same staffing level on an engine company to a reported structural fire is inadequate and would limit the safe deployment and utilization of this vehicle until sufficient staffing resources arrived at the scene to supplement the understaffed apparatus.*

*Historically since 1958 the fire department has acquired seventeen pieces of new apparatus with an average of one new vehicle every 3.55 years. Attempting to maintain an in service fleet of ten major vehicles, excluding heavy forestry units would require vehicles to have a life cycle in excess of twenty years, which is evident as four pieces of apparatus including Engine's 3, 4 and 10, along with Tanker 1 all exceed this benchmark. While the department has continued to maintain three pieces of apparatus in Stations 2 and 3, much of this has been based on past practices as each of the current vehicles were replaced one for one as funding became available. When the former Engine 2, a 1984 American LaFrance experienced pump damage at a fire, this caused the department to acquire a used vehicle, Engine 4 as a temporary replacement. The addition of this vehicle, which is not equipped to act as a ready, reserve unit has added to the "fleet creep" within the department and cost over \$23,000 dollars to maintain over the past three years.*

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*The current condition of several vehicles, together with older units such as Engine 4, Engine 10, Forestry 1 and Forestry 2 which should be removed from service indicate that the overall fleet condition needs to be addressed, along with a right sizing of the apparatus fleet. With only one new engine apparatus acquired since 2001 this has served to complicate future fleet replacement as the department and Town of Grafton should not be put into the position of supporting multiple apparatus acquisitions in any one year.*

*Following is a three year summary of department incident responses:*

**Table 4.1 Responses by Year-Incident Type**

<b><u>Year</u></b>	<b><u>2012</u></b>	<b><u>2013</u></b>	<b><u>2014</u></b>	<b><u>2015</u></b>
<i>Fires</i>	43	50	52	69
<i>Automatic/False Alarms</i>	160	161	200	207
<i>Smoke Investigation</i>	28	33	38	99
<i>Rescue &amp; EMS</i>	35	25	64	47
<i>Hazardous Condition</i>	72	78	48	23
<i>Brush</i>	23	3	15	24
<i>Other Alarms</i>	29	76	53	73
<b>Total</b>	390	426	470	542

*The number of incident responses has increased each year over this period with a significant number of calls for automatic alarms, smoke investigations and some other non-fire related responses. The number of reported structural and outside fires has remained fairly constant over this same period. There has been an average of sixteen brush and wildland fires over the past four years. While this does not diminish the importance for off road, four wheel drive forestry apparatus, the Town of Grafton and fire department chief officers should investigate the availability of well maintained, government surplus vehicles which can be modified for wildland fire fighting at a nominal cost due to the need to establish and fund a viable fleet replacement program for the structural and rescue apparatus.*

*Following is a summary of the major apparatus mileage, operating hours and maintenance costs, based upon available fire department records for the period.*

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**Table 4.2 Apparatus Summary**

<b><u>Unit</u></b>	<b><u>Mileage</u></b>	<b><u>Engine Hours</u></b>	<b><u>Repair Costs 2012-2016</u></b>
Engine 1-1990	25,048	2980	\$36,488
Engine 2-2014	6836	497	\$7323
Engine 3-1994	19,741	1829	\$10,778
Engine 4-1982	21,079	N/A	\$23,263
Engine 10-1990	7846	N/A	\$16,141
Tower 1-2001	14,089	455-PTO Hours	\$32,240
Truck 6-2009	5994	N/A	\$26,188

Note: R/M expenses includes \$23,627 in accident repair costs from 2012

Rescue 1-2014	3036	192	\$10,397
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*Note: No repair and maintenance costs were listed for the two heavy forestry trucks and the tanker during this period. Also, there were no costs noted for pump testing certification nor aerial tower testing certification for the same period. The repair cost amounts are based upon a review of available records provided by the fire department including vendor invoices. These costs may not capture all of the operating costs as there were time frames where no outside vendor invoices were listed and do not include insurance, fuel and other ancillary expenses.*

*The age of the department's current apparatus fleet is spaced out over a period of fifty years with the oldest unit Forestry 3 originally built in 1966 and the newest vehicle, Forestry 2 placed into service during 2016. Beginning in 1990, the fire department was able to replace existing vehicles in the fleet averaging 3.7 years between each major acquisition. Since 2005, four new pieces of apparatus have been acquired, including a new engine, air/light unit, heavy rescue and a Type 6 brush truck. During 2011, Engine 4 was acquired as a used unit to provide an immediate replacement for Engine 2 when the pump was damaged at an incident.*

*As a result of the past purchasing practices which were largely determined by available fire station bay space and financial resources made available by the Town of Grafton, the departments current fleet has grown to thirteen vehicles, including the two heavy forestry units on loan from the Massachusetts Bureau of Forestry and a utility truck that was transferred from the Town sewer department to the fire department. Several of the department's special service vehicles, Rescue 1 and the air/light unit Truck 6*

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*have some duplication of equipment including air cascade system, light tower and support gear which could be combined into a single vehicle at some point in the future.*

*Each piece of apparatus operated by the fire department has been carefully analyzed for its condition and maintenance features, with projected replacement dates given for each unit. These dates reflect the year in which the replacement unit should be delivered and placed into service by the department. Recognizing that most fire apparatus takes approximately eight to twelve months to produce once the unit goes under contract, adequate research and planning must be provided to insure that the apparatus is delivered and placed into service on a timely basis.*

*Emergency Vehicle Response will provide a detailed listing of recommendations for each apparatus in addition to suggestions for vehicle configuration, range of critical dimensions and components which should be included within the department's technical specifications for replacement vehicles including engine, engine/tanker and forestry units. The complexity of today's fire apparatus requires an extensive knowledge of vehicle design, current National Fire Protection Association standards, together with a practical approach to developing vehicle specifications. The Town of Grafton should be commended for supplying the necessary financial resources to purchase the vehicles in the current apparatus fleet. With an average age at replacement of over twenty eight years, the past units have served the department and community well. The planned fleet replacement will advance the safety and operational capabilities of each vehicle and will have a direct impact on reducing the cost of repairs and maintenance with the retirement of aging, repair prone units from the fleet.*

*The Grafton Fire Department should adopt one of the options listed in the fleet replacement program as outlined in Section 8.0 to insure that apparatus is replaced on a regular, programmed basis. With an aging feet in fair condition, future purchases will need to follow the developed plan with only minor deviations allowed for unanticipated repairs or accidents. Where possible apparatus purchases should continue to be spaced out with three to four years between each major suppression apparatus.*

### **5.0 Fleet Review and Evaluation:**

#### **5.1 Engine 1:**

*This apparatus is a 2000 American LaFrance Eagle chassis with stainless steel bodywork built by 3-D Fire Apparatus. The apparatus is equipped with a Waterous CSU 1500 gpm single stage fire pump with top mount pump controls along with a 1250 gallon water tank. The engine is also provided with a Hale Foam Master Class A foam system that has been the source of extensive maintenance repairs in an attempt to keep the system operational. The apparatus is powered by a Cummins ISC engine rated at 350 horsepower engine through an Allison MD-3066P automatic transmission. This unit was built with a 217.00 inch wheelbase and an overall length of 33 feet 7 inches and cost \$260,790 dollars when new. Unfortunately, neither American LaFrance nor the body builder are still actively engaged in the fire apparatus industry which would make replacement parts difficult and expensive to acquire in the future.*



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*The apparatus is equipped with an 18,000 pound rated front axle and a 31,000 pound rated rear axle. Without personnel the apparatus weighs 15,800 pounds on the front axle and 27,000 pounds on the rear axle. Engine 1 is equipped with nine body compartments with hinged doors. The exterior of the cab and body are in mainly good condition with portions of the chassis frame rails and components showing signs of rust and corrosion. The tires are sixteen years old and are all in need of replacement.*

*The exterior of the body has several areas where moderate rust and corrosion is evident which will at some point require corrective action to mitigate further damage. The interior of the cab has several pieces of equipment which are improperly stored and secured including battery chargers and a step ladder which are safety hazards to personnel. In addition, forcible entry tools mounted on the rear of the cab are not mounted in NFPA 1901 required 9G rated brackets.*

*The engine is equipped with a 28 foot extension ladder along with a 14 foot roof ladder and 10 foot folding ladder. The hose load includes a 100 foot 1.75 inch bumper mounted trash line, one 150 foot and one 200 foot 1.75 inch attack lines along with a 200 foot 2.00 inch attack line in three speedlay hose beds, each equipped with an Elkhart automatic fog nozzle. The rear hose bed carries 1000 feet of 4.00 inch supply line, two 200 foot 2.50 inch attack lines and one 100 foot 1.75 inch line with a piercing applicator.*

*The hose bed is approximately 92.00 inches from the ground to the bottom of the bed and requires personnel to use a combination of folding and fixed steps to reach this area. The engine also carries a preconnected deck gun equipped with smooth bore tips. Some equipment carried inside of the body is mounted and secured, with several appliances and hand tools carried loose.*

*The chassis frame rails, battery boxes, fire pump enclosure and the steel body sub-frame all need to be steam cleaned and are in fairly good condition for the age of the vehicle. Due to the need to acquire a new engine/tanker and a replacement for Engine 3, which is twenty two years old, despite the extensive repairs to this unit, Engine 1 needs to remain in the fleet for several more years.*

*Once the new engine/tanker is acquired and placed into service it should be assigned to Station One and operated as the first due unit to all reported structural fires and other calls that would normally be answered by Engine 1. The American LaFrance engine should then be placed into reserve service until its scheduled replacement in 2023 when the unit would be twenty two years old. While not an ideal situation, the department has a greater need to provide a reliable tanker to provide water supply and engine company service to the greater areas within the Town that are not serviced by fire hydrants.*

### **5.2 Engine 1 Recommendations:**



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*The following items are recommended to be implemented on Engine 1 for the purpose of supporting the operation of this apparatus only as a second line vehicle until a new, engine/tanker can be acquired in accordance with Section 8.1:*

- 1. The chassis frame rails, body substructure and exposed fire pump components should be thoroughly steam cleaned with all exposed rust and corrosion removed. Moderate rust and corrosion was noted on the chassis frame rails, battery boxes and cross members. The chassis steam cleaning should be conducted on at least an annual basis to remove accumulated dirt, road debris and surface rust from the chassis and other components.*
- 2. In accordance with NFPA 1911 Standard on the Inspection, Maintenance, Testing and Retirement of In Service Automotive Fire Apparatus, Chapter 18 each engine apparatus in the department's fleet should be service tested at least annually and after major repairs.*
- 3. All six (6) tires on the apparatus should be replaced with tires having a similar size, tire weight rating and tread pattern.*
- 4. Appliances, tools and equipment carried inside of the cab and body compartments should be properly mounted and secured with suitable 9G rated brackets and stainless steel hardware to protect the equipment. The metal clipboard, battery chargers and step ladder should be removed from the interior of the cab and carried inside of a body compartment or secured with certified 9G rated brackets.*
- 5. The portable ground monitor carried in the right front body compartment should be preconnected to a 150-200 foot 2.50 inch line in the rear body hose bed.*
- 6. Each attack line carried in the rear hose bed should be loaded in an efficient and safe manner to permit personnel to stretch and advance the line without having to climb onto the apparatus.*
- 7. The door gasket rubber on the rear body roll up door should be replaced to reduce the infiltration of dirt and road debris into this compartment.*
- 8. No additional funds should be expensed to repair or replace the foam system on this apparatus. As Engine 2 is equipped with a compressor air foam system there is limited requirement to maintain two vehicles in the department's fleet with foam systems.*
- 9. Repairs should be initiated on a timely basis to repair the paint damaged areas on the rear body and around the door hardware on the compartment doors.*



**Image 5.3 Rear body paint on Engine 1**



**Image 5.4 Rear spring suspension on Engine 1**



**Image 5.5 Step ladder carried inside of Engine 1 crew area**

**5.6 Engine 2:**



## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*The front line apparatus assigned to the North Grafton Fire Station is Engine 2, a 2012 Pierce Saber four door raised roof pumper and is equipped with top mounted pump controls with a Waterous CSU single stage fire pump rated at 1500 gpm with a 1000 gallon water tank. The engine is equipped with a Pierce Husky foam system and 200 cfm compressor along with a 30 gallon foam cell. This vehicle is powered by a Cummins ISL9 motor rated at 450 horsepower with an Allison EVS-3000 automatic transmission. This engine is built on a wheelbase of 202.50 inches with an overall length of 31 feet 9 inches. This apparatus cost \$382,724 dollars when acquired. The apparatus has seating for six personnel with five SCBA seats.*

*The engine is in good condition and is equipped with an aluminum cab and stainless steel body with a steel sub-frame and hinged body compartment doors. The Saber chassis is equipped with an 18,000 pound rated front axle and a 27,000 pound rated rear axle and in service weighs of 14,600 pounds on the front and 25,240 pounds on the rear axle. A 24 foot extension ladder, 14 foot roof ladder and folding ladder are carried on the right side body along with a good array of appliances, hand tools and equipment. Unfortunately, while the apparatus was well designed, very few pieces of equipment are properly mounted and secured, with unused area in the left front and rear body compartments.*

*Engine 2's attack line compliment consists of a 100 foot 1.75 inch trash line, one 150 foot and one 200 foot long 2.00 inch attack lines loaded in a speedlay hose beds, each equipped with smooth bore nozzles. The rear hose bed carries 1000 feet of 4.00 inch hose together with a 200 foot 2.00 inch and 200 foot 2.50 inch preconnected attack lines. Another hose bed carries 200 feet of 1.75 inch hose with a low velocity fog applicator for vehicle fires. Master stream capability is provided by a top mounted deck gun appliance equipped with smooth bore tips. The rear hose bed is 87.50 inches above the ground.*

*During the field inspection an excessive amount of moisture was drained from the chassis air tanks indicating that they had not been operated for some time. The chassis frame rails and radiator need to be steam cleaned to reduce the damage due to road salt and chemicals.*

### **5.6 Engine 2 Recommendations:**

*The following items are recommended to be implemented on Engine 2 to improve the safety and operational capabilities of this apparatus:*

- 1. The chassis frame rails, body substructure and exposed fire pump components should be thoroughly steam cleaned with all exposed rust and corrosion removed. The chassis steam cleaning should be conducted on at least an annual basis to remove accumulated dirt, road debris and surface rust from the chassis and other components.*
- 2. In accordance with NFPA 1911 Standard on the Inspection, Maintenance, Testing and Retirement of In Service Automotive Fire Apparatus, Chapter 18 each engine*

## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*apparatus in the department's fleet should be service tested at least annually and after major repairs.*

*3. Appliances, tools and equipment carried inside of the body compartments should be properly mounted and secured with suitable 9G rated brackets and stainless steel hardware to protect the equipment.*

*4. The chassis air reservoirs should be provided with drain valves and stainless steel cables extended to the side of the body to permit personnel to drain the air system on a regular basis without having to climb under the apparatus.*

*5. The Paratech brand halligan tool carried in the L-3, left side body compartment should be removed from service and replaced with a drop forged, single piece halligan tool similar to a Fire Hooks Unlimited Pro Bar.*

*6. Each attack line carried in the rear hose bed should be loaded in an efficient and safe manner to permit personnel to stretch and advance the line without having to climb onto the apparatus.*

*7. The forcible entry hook carried alongside the officer's seat should be removed from the cab or mounted and secured with a NFPA 1901 9G compliant bracket and stainless steel hardware.*

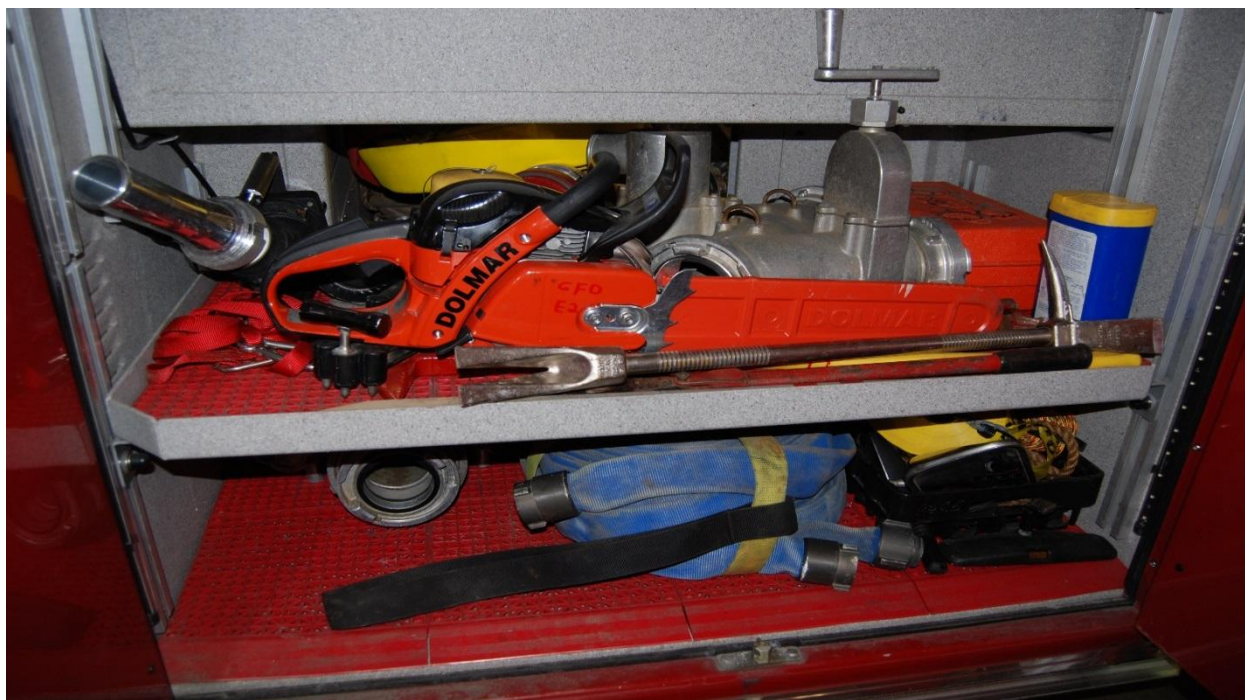
*8. The portable ground monitor carried in the left rear L-3 body compartment should be preconnected to a 150-200 foot 2.50 inch line in the rear body hose bed.*

*9. The four inch supply line bed should be connected to the four way hydrant valve along with a layout pack consisting of a hydrant wrench, spanner and 2.50 inch hydrant gate.*

*10. To the extent possible, spare nozzles, fittings, hand tools and equipment locations should be standardized on the three front line engines operated by the department. As Engine 2 is the newest engine apparatus in the fleet, the use of tool boards similar to Pac Trac, pegboard or other similar material should be utilized to mount and secure all equipment carried on the apparatus.*



**Image 5.7 Unsecured hand tool adjacent to officers seat on Engine 2**



**Image 5.8 Unsecured equipment on Engine 2**





**Image 5.9 Engine 2 rear body compartment with spare 2.00 inch and 4.00 inch hose  
Four way hydrant valve and hydrant bag carried loose on slide tray**

**5.10 Engine 3:**

**EMERGENCY VEHICLE RESPONSE FIRE  
PROTECTION SERVICES**



## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*The single apparatus assigned to the South Grafton Fire Station is Engine 3, a 1994 Pierce Saber four door pumper built with top mounted pump controls and equipped with a Waterous CSU single stage fire pump rated at 1500 gpm with a 1000 gallon water tank. The apparatus is powered by an International 530 engine rated at 300 horsepower with an Allison MD-3060P automatic transmission. This engine is built on a wheelbase of 198 inches with an overall length of 31 feet 1 inch. The apparatus has seating for six personnel with five SCBA seats.*

*The engine is in mainly good condition for its age and is equipped with an aluminum cab and galvanneal steel body with a steel sub-frame and hinged body compartment doors. The Saber chassis is equipped with a 16,000 pound rated front axle and a 26,440 pound rated rear axle with in service weighs of 14,300 pounds on the front and 22,900 pounds on the rear axle. The ground ladder compliment includes a 28 foot extension ladder, 16 foot roof ladder and 10 foot folding ladder are mounted on the right side body. The body is equipped with nine enclosed compartments and carries an assortment of spare nozzles, appliances, donut rolls of hose and a compliment of Hurst including spreader, O-cutter, ram and gas powered motor. All of the rescue tools and stabilization equipment is duplicated in greater amount on Rescue 1 which is housed in the same station.*

*Engine 3's attack line compliment consists of one, 150 foot 1.75 inch and one 150 foot long 2.00 inch attack lines carried in crosslay hose bed, above and behind the top mount pump panel, each equipped with Elkhart SM-30 automatic fog nozzles. The rear hose bed carries 1000 feet of 4.00 inch hose in a split bed together with a 200 foot 2.50 inch preconnected attack line. Another hose carried includes two, 200 foot long 1.75 inch attack lines supplied through a gated wye at the right side rear of the body. Master stream capability is provided by a top mounted deck gun appliance equipped with smooth bore tips.*

*The design of the apparatus body limits access to the crosslay hose beds on the right side due to the position of the ground ladders and height of the hose bed area from the ground. Several pieces of equipment are carried inside of the crew cab portion of the vehicle including a Pelican box along with four spare SCBA cylinders stored in PVC tubes. All of this equipment could severely injure personnel in the event of an accident. Axes are mounted on the rear of the cab that are not properly secured. As the vehicle was built prior too many of the current day NFPA 1901 Standards the step surfaces are not slip resistant, the cab and body warning lights are limited and only some pieces of equipment are properly stored and mounted inside of the body compartments.*

*Engine 3 should be the second unit replaced under the fleet replacement program during 2020 with a short wheelbase engine equipped with a 50 to 65 foot telescopic water tower along with an enhanced complement of ground ladders and a minimum of six preconnected attack and leader lines as listed in Section 8.2 of this report.*

### **5.11 Engine 3 Recommendations:**

## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*The following items are recommended to be implemented on Engine 3 to improve the safety and operational capabilities of this apparatus:*

- 1. The chassis frame rails, body substructure and exposed fire pump components should be thoroughly steam cleaned with all exposed rust and corrosion removed. The chassis steam cleaning should be conducted on at least an annual basis to remove accumulated dirt, road debris and surface rust from the chassis and other components. The radiator should be cleaned of all leaves and debris which are inhibiting the air flow across the front of the radiator.*
- 2. In accordance with NFPA 1911 Standard on the Inspection, Maintenance, Testing and Retirement of In Service Automotive Fire Apparatus, Chapter 18 each engine apparatus in the department's fleet should be service tested at least annually and after major repairs.*
- 3. Appliances, tools and equipment carried inside of the body compartments should be properly mounted and secured with suitable 9G rated brackets and stainless steel hardware to protect the equipment.*
- 4. The Pelican box should be removed from the cab with the spare SCBA bottles secured in NFPA compliant 9G rated brackets and hardware.*
- 5. The Paratech brand halligan tools carried on the apparatus should be removed from service and replaced with a drop forged, single piece halligan tool similar to a Fire Hooks Unlimited Pro Bar.*
- 6. Each attack line carried in the crosslay and rear hose bed should be loaded in an efficient and safe manner to permit personnel to stretch and advance the line without having to climb onto the apparatus.*
- 7. The two front tires are heavily worn and should be replaced with tires that have the same size, weight rating and similar tread pattern.*
- 8. A smooth bore nozzle with a 1.125 inch tip should be provided and installed on the rear body 2.50 inch attack line.*
- 9. The axes mounted on the rear exterior of the cab should be mounted in NFPA 1901 compliant 9G rated and certified brackets with stainless steel hardware.*



**Image 5.12 Rear cab axe mounting on Engine 3**



**Image 5.13 Battery tray corrosion on Engine 3**

**5.14 Engine 4:**



## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*This unit is a 1982 Ford C-8000 tilt cab chassis built by Pierce Manufacturing, having been acquired in May, 2011 from the New Castle, New Hampshire Fire Department. This vehicle was initially utilized by the department to replace the damaged Engine 2 at the North Grafton station and since 2012 has been serving as an unequipped reserve engine, quartered at Station One. The engine carries a Waterous 1000 gpm single stage pump with top mount controls with a 500 gallon water tank. The apparatus is powered by a Caterpillar 3208 diesel engine rated at 210 horsepower through an Allison MT-643 automatic transmission. The apparatus is built with a 175 inch wheelbase with an overall length of 26 feet 5 inches.*

*Engine 4 can accommodate two personnel in the forward, enclosed cab with a three person bench seat in the open, rear facing canopy area. The engine is equipped with a 12,000 pound front axle and 23,000 pound rear axle with in-service weights of 9960 pounds on the front and 17,240 pounds on the rear with the vehicle being partially equipped with hose and ladders. The body is constructed of galvanized steel and equipped with ten enclosed compartments. The apparatus is only partially equipped with five SCBA's, some adapters and ground ladders including a 28 foot extension and 14 foot roof ladder that are held in place with bungee cords.*

*Engine 4's attack line complement consists of one, 150 foot 1.75 inch and one 200 foot long 2.00 inch attack lines along with a 200 foot long 2.50 inch attack line in the rear hose bed. Supply line hose carried is 1000 feet of 4.00 inch with a four way hydrant valve. The engine is equipped with a booster reel and carries a two inlet deck gun over the fire pump with smooth bore tips.*

*Over the past four years repair and maintenance costs for this apparatus has far exceeded the residual scrap value for the unit. Among the safety issues with this apparatus is the open canopy seating area, lack of non-slip step surfaces, heavy rust and corrosion on the cab in the front fender wells, lack of reflective Scotchlite on the cab and body, inadequate warning lights, non-compliant SCBA mounting along with other mechanical issues. Due to the age and condition of this vehicle it cannot be considered to be an operationally safe reserve engine and should be declared surplus and removed from service.*

*At thirty four years, Engine 4 is one of the oldest units in the department's fleet and was utilized to fulfill a short term need when the 1984 American LaFrance pumper sustained major fire pump damage at a large scale incident. There is no demonstrated need to maintain this apparatus in the department's fleet and the roll of a second line engine apparatus can be fulfilled with the recommended acquisition of a combination engine/tanker apparatus, assigned to Station One to replace both Tanker 1 and Engine 4. This new apparatus will be designed to provide both engine company and water supply services and will provide some relief to the repair and maintenance budget with the removal of two, older vehicles from the current fleet.*



**Image 5.15 Engine 4 Equipment compartments**



**Image 5.16 Engine 4 inner front cab fender corrosion**

**5.17 Engine/Forestry 10:**

## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*Engine 10 is assigned to the North Grafton station and operates a 1990 Ford F-700 two door cab built by American Eagle Fire Apparatus, a company that is no longer in business. This apparatus serves as a brush/forestry unit and could be utilized in an emergency as a back-up unit to Engine 2, although the vehicle can carry only two personnel and carries minimal engine company equipment. The apparatus is equipped with a Darley front mount 500 gpm single stage pump a 500 gallon water tank and rear mounted forestry hose reel. The apparatus is powered by a Ford diesel engine rated at 210 horsepower through a four speed automatic transmission. The apparatus is built with a 153 inch wheelbase with an overall length of 26 feet 2 inches.*

*Engine 10 is equipped with a 9000 pound front axle and 18,000 pound rear axle with in-service weights of 7760 pounds on the front and 13,120 pounds on the rear. The body is constructed of aluminum with aluminum tread plate compartment doors and equipped with six enclosed compartments along with a rear mounted winch. The apparatus is only partially equipped for engine company service with two SCBA's, some adapters, brush fire equipment, vest tanks and a single 20 foot extension ladder.*

*The hose line compliment on Engine 10 consists of two forestry hose reels, one 200 foot 1.50 inch attack line along with a 400 feet of 1.00 inch and 500 feet of 1.50 inch hose. The rear hose bed carries 400 feet of 4.00 inch with a four way hydrant valve. This apparatus at just over twenty six feet in length, barely fits into the fire station with limited room between the rear step of Engine 2 and the front bumper of Engine 10. The rear body and hose bed area of Engine 10 cannot be accessed unless the rear overhead door is opened.*

*During 2012 repairs to the fire pump and transfer case cost \$4488 dollars with repairs to the chassis hydraulic brake system costing \$7165 dollars. Due to the age of the chassis, parts to successfully complete these repairs were difficult to locate and required some time to locate the correct components. The actual number of unit responses for this apparatus over the past few years could not be easily determined, however the utilization of this vehicle as a back up to Engine 2 cannot be justified, and much the same as the age, condition and equipment placement of both Engine 4 and Engine 10 do not lend themselves for this purpose.*

*Among the safety issues with the vehicle is that all tires are out of date and in need of replacement, lack of non-slip step surfaces, lack of reflective Scotchlite on the cab and body compartments, inadequate warning lights, lack of adequate engine company equipment, preconnected attack lines along with other mechanical issues. Engine 10, upon delivery and acceptance of the new engine/tanker should be declared surplus and removed from service at that time during 2017. Should there be a determined need to maintain a brush/forestry vehicle at Station Two, then a unit similar to Forestry Two, a 2016 Ford pick-up chassis with a skid unit could be considered for assignment at some point in the future.*



**TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**



**Image 5.18 Engine 10 Left front compartment equipment storage**



**Image 5.19 Engine 10 Rear body and hose bed**

**5.20 Tower 1:**

**EMERGENCY VEHICLE RESPONSE FIRE  
PROTECTION SERVICES**



## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*Tower 1 is the fire department's second truck company, replacing a 1965 American LaFrance 100 foot aerial ladder in 2001. This apparatus is a Pierce Dash raised roof 95 foot midship tower and is equipped with a Hale 8FG model 1500 gpm pump with a 200 gallon water tank. The chassis cab and body are constructed of aluminum with a wheelbase of 270 inches and an overall length of 45 feet 11 inches. When new, the apparatus cost \$694,979 dollars it was acquired as a stock vehicle was in the process of being constructed at the Pierce Manufacturing facility and was modified to meet the intent of the Grafton Fire Department specification requirements. The apparatus is powered by a Cummins ISM engine rated at 500 horsepower through an Allison HD-4060 automatic transmission. The apparatus is capable of seating six personnel in the cab with five seats provided with self-contained breathing apparatus.*

*The aerial tower is equipped with front axle rating of 21,500 pounds with a rear axle rating of 58,000 pounds with in service weights of 18,400 pounds on the front and 56,000 pounds on the rear axle without personnel. With a gross vehicle weight rating of 79,500 pounds this apparatus is the heaviest unit in the department's fleet and due to the overall size and weight, there are some roadways and access points in residential areas where the placement of this unit could be limited due to approach angles and other obstructions.*

*The aluminum body is equipped with seven enclosed compartments which carry an assortment of hand tools, ventilation saws, fans, salvage equipment and a 6.0 Kw hydraulic generator. Preconnected attack lines carried are one 150 foot and one 200 foot long 1.75 inch lines in crosslay hose beds each with automatic nozzles together with 1000 feet of 4.00 inch supply line on the right side body, above the lower compartments.*

*A total of 115 feet of portable ground ladders are carried including one 35 foot and one 24 foot extension ladders together with two 16 foot roof ladders, 14 foot jack ladder and a 10 foot folding ladder. The ground ladder compliment on the tower is very limited due to the space allocated for the water tank and supply line hose beds. Few tools and equipment are properly and securely mounted within the body compartments as noted in the attached photos. The platform is rated at 1000 pounds when not operating as a water tower and is equipped with two monitors. The remote control monitor is provided with an automatic nozzle with a smooth bore nozzle carried on the manually controlled gun.*

*The aerial tower ladder has not been inspected by an outside testing company over the past few years and no certification labels were provided on the vehicle to indicate compliance with NFPA 1911, the maintenance and testing standard for fire apparatus. All tires on the front and rear axles are out of date and in need of replacement. Equipment inside of the forward and cab crew seating areas and tower platform are not mounted and not secured, creating a safety hazard for personnel operating in these areas.*

*In addition to the twenty eight foot extension ladders carried on Engine's 1 and 3 and the limited ladder compliment on Tower 1, there is a demonstrated need to expand the portable ladder capabilities in the*

## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*department. There are any number of three and four story buildings within the response district where 28 to 35 foot extension ladders would be required to cover multiple sides of the structure that cannot be accessed by the aerial tower. These ground ladders are essential to provide a means of access for fire personnel to upper stories and more importantly for egress in the event fire personnel operating on the floor above the fire or any upper level would be cut off from the interior stairs and path of escape.*

*Examples of these types of building and structural conditions within the Town of Grafton are noted below:*



**Image 5.21 Three story frame dwelling, Orchard Street in South Grafton**





**Image 5.22 Broadmeadow Apartments on Providence Road, South Grafton**



**Image 5.23 Three story residential homes on Magill Drive**

***5.24 Tower Ladder 1 Recommendations:***

***EMERGENCY VEHICLE RESPONSE FIRE  
PROTECTION SERVICES***

## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*The following recommendations should be initiated immediately and be completed during the coming year to improve the safety and operational capabilities of the ladder company apparatus:*

- 1. The metal clip board carried on top of the engine cover along with the Pelican box and egg crate should be removed from the interior of the cab or properly secured with NFPA 1901 compliant 9G rated brackets.*
- 2. The interior of the rear ladder compartment and the ground ladders should be thoroughly cleaned of rust and corrosion and lubricated in accordance with the manufacture's recommendations. Consideration should be given to replacing the extension ladder halyards with synthetic rope.*
- 3. The chassis frame rails, radiator and components should be periodically steam cleaned to remove surface rust and corrosion from this area. There is a minor buildup of rust and corrosion on the body sub-frame.*
- 4. All tires on the front and rear axles are out of date and in need of replacement with similar size, weight ratings and tread patterns as the originally supplied tires.*
- 5. The Dover roll up shutter door for the ground ladders is in need of adjustment. The inside of the ground ladder bays needs to be cleaned of accumulated road dirt and debris. The length of each ground ladder should be clearly identified with reflective number inside of the ground ladder bays.*
- 6. In accordance with NFPA 1911 Standard on the Inspection, Maintenance, Testing and Retirement of In Service Automotive Fire Apparatus, section 16.2 each apparatus in the departments fleet should be weighted annually on the front and rear axles individually as well as the entire apparatus to insure that the unit is within the vehicle weight ratings as supplied by the manufacturer.*
- 7. All tools and equipment carried inside of the body compartments including forcible entry tools, extinguishers, gas powered saws and appliances should be mounted and secured. The interior compartments are being damaged due to the unrestrained equipment carried on the apparatus.*
- 8. The chassis air reservoirs should be provided with drain valves and stainless steel cables extended to the side of the body to permit personnel to drain the air system on a regular basis without having to climb under the apparatus.*

## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*9. The door gasket rubber on the rear body roll up door should be replaced to reduce the infiltration of dirt and road debris into this compartment.*

*10. The roof hook, halligan tool and axe carried inside of the platform basket should be mounted and secured with 9G rated brackets and hardware. The Elkhart SM-100 automatic fog nozzle should be removed from the platform interior and mounted inside of a body compartment.*

*11. The aerial tower and all ground ladders should be subjected to annual certification tests by a recognized outside testing agency with all required repairs completed in a timely manner.*

*12. A 12 to 14 inch long stream shaper should be provided and installed on the manually controlled monitor in the platform.*

*13. Access to the tower platform at the left, rear corner of the body should be improved with the addition of a serrated, non-slip handrail at the left corner of the platform exterior wall to enhance the safety for personnel when accessing this area.*

*14. The spare 2.50 inch nozzle, exposure nozzle, hydrant wrench and other equipment located on the floor of the L-1, left front body compartment should be mounted and secured to prevent damage to the circuit breaker box and generator meters.*

*15. The roof hook presently mounted in tulip clips at the left rear corner of the body under the platform should be secured with NFPA 1901 compliant 9G rated brackets and stainless steel hardware.*

*16. The fiberglass step ladder that is carried loose on the 4.00 inch supply line hose bed should be relocated if the intent is to utilize the supply hose and properly secured above the body with NFPA compliant 9G rated brackets and stainless steel hardware.*





**Image 5.25 Compartment equipment storage on Tower 1**



**Image 5.26 Loose equipment inside crew cab on Tower 1**





**Image 5.27 Air reservoir corrosion on Tower 1**



**Image 5.28 Gas powered saw equipment on Tower 1**

**5.29 Rescue 1:**

**EMERGENCY VEHICLE RESPONSE FIRE  
PROTECTION SERVICES**



## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*Rescue 1 was placed into service in 2014 by the fire department, replacing a 1988 Ford/American Eagle unit. This vehicle is a Pierce Impel four door raised roof cab and chassis with a stainless steel non-walk in walk rescue body. The crew cab is capable of carrying eight personnel with seven SCBA seats. The apparatus is powered by a Cummins ISL engine rated at 400 horsepower though an Allison EVS-3000 automatic transmission and is built on a 246.50 inch wheelbase with an overall length of 38 feet.*

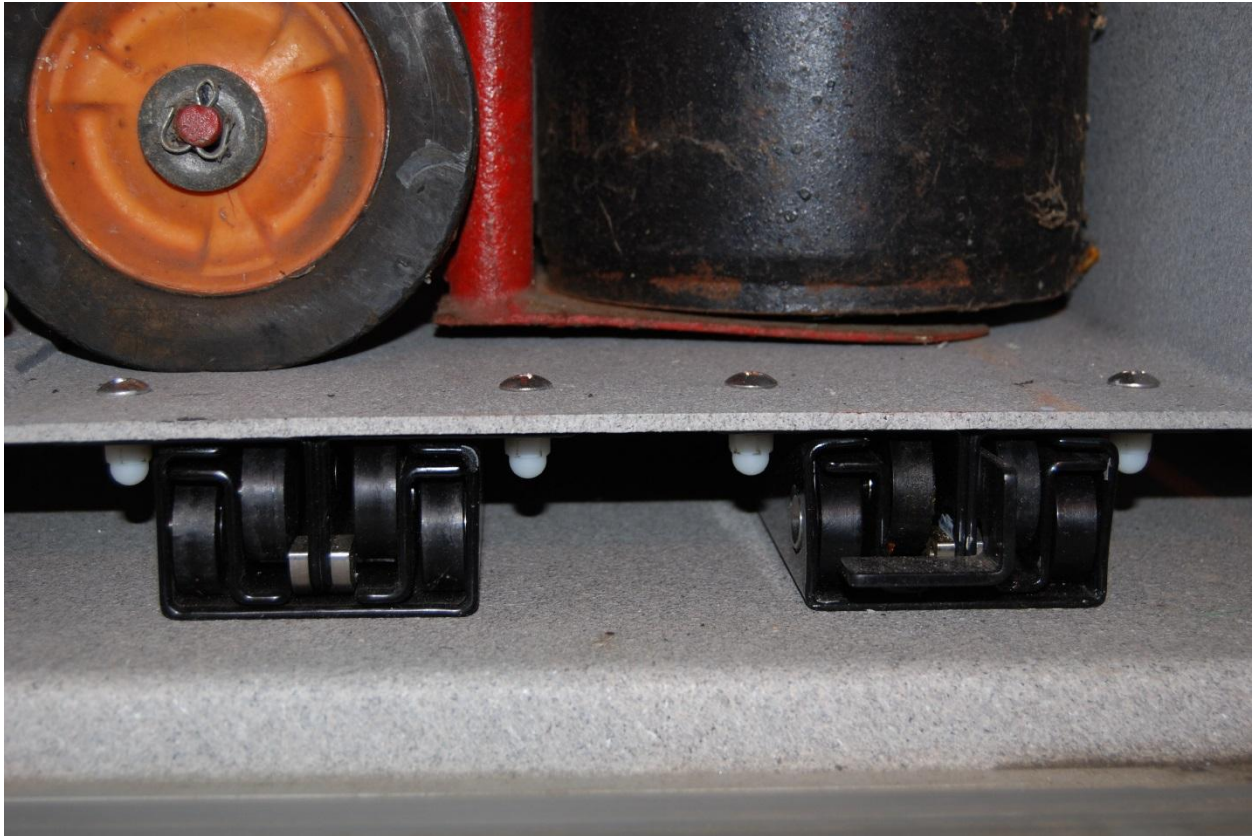
*Rescue 1 responds as the first due unit from Station Three to all vehicle accidents and second due to all structural fires. The apparatus is equipped with an Onan 25.0 Kw PTO generator, air compressor, light tower, two electric cable reels, hydraulic reels supplied by an on board power system, a four bottle air cascade system with a Sierra booster together with an assortment of shoring blocks, air bags and a front mounted 12,000 pound rated electric winch. Other equipment carried includes a portable 9000 pound winch with receiver hitches, battery powered Hurst rescue tools, power saws, forcible entry tools, rescue struts and portable lighting.*

*The front axle rating on the rescue truck is 22,800 pounds with a rear axle rating of 31,000 pounds. The current in service weights for this unit without personnel is 18,860 pounds on the front and 26,120 pounds on the rear axle. The vehicle is outfitted with nine lower and four upper body compartments with most all tools and equipment mounted and secured inside of the rescue body. A pull down access ladder provides safe access to the upper body compartments. Much of the equipment carried on this apparatus could be utilized for supporting truck company operations and can provide the needed tools and equipment that are not carried on Tower 1. Overall, Rescue 1 is a well-designed apparatus that should serve the community well for many years.*

### **5.30 Rescue 1 Recommendations:**

*The following items are recommended to be implemented on the rescue truck to improve the safety and operational characteristics of this apparatus:*

- 1. Floor mounted slide trays should be isolated from the stainless steel body with Nylatron or poly material to prevent corrosion due to dissimilar materials in this area.*
- 2. The chassis air reservoirs should be provided with drain valves and stainless steel cables extended to the side of the body to permit personnel to drain the air system on a regular basis without having to climb under the apparatus.*
- 3. The chassis frame rails, radiator and components should be periodically steam cleaned to remove surface rust and corrosion from this area. There is a minor buildup of rust and corrosion on the body sub-frame.*



**Image 5.31 Rescue 1 Slide tray hardware floor mounts**

### **5.32 Truck 6:**

*This unit is a combination air/light unit, a 2009 International 4900 four door cab commercial cab and chassis with a non-walk in rescue body constructed by Pierce Manufacturing. The aluminum body has seven enclosed compartments and has the capability of carrying five personnel in the cab. The apparatus is powered by an International Maxxforce engine rated at 310 horsepower engine though an Allison model EVS-3000 automatic transmission. The vehicle is built with a 219.00 inch wheelbase with an overall length of 29 feet 6 inches.*

*The front axle rating on Truck 6 is 12,000 pounds with a rear axle rating of 23,000 pounds. The current in service weights for this unit are 8840 pounds on the front and 15,640 pounds on the rear axle without personnel. While the vehicle is not in any danger of being overloaded, the chassis gross vehicle weight rating of 35,000 pounds is over 9000 pounds under the unit's in-service weight. During operations particularly on wet or snow covered roadways, the vehicles braking performance should be carefully monitored.*

## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*The apparatus is equipped with an Onan 25.0 Kw power take off driven generator, light tower, electric cable reels, four bottle air cascade system with Sierra air booster, spare SCBA's and bottles along with PPV fans and gas powered saws. The spare SCBA bottles are stored in two modules, one at the rear of the body adjacent to the fill station and a second one in the R-2, right side body compartment. Most portable equipment carried on Truck 6 is not mounted or secured with many pieces lying on compartment floors or slide trays including fans, saws, hand tools and extinguishers.*

*Truck 6 replaced a smaller Chevrolet four door cab chassis with a utility body that was assigned to Station 2. While there may be a need for an auxiliary utility and personnel carrier at this location, the requirement for this type of vehicle should be determined by the department chief officers. Much of the equipment carried on Truck 6 is duplicated in Rescue 1 including the air cascade system, air booster, light tower and on board generator. Based upon the overwhelming need to update the department's engine, water tanker and forestry apparatus with newer units there is no requirement to replace Truck 6 with a similar size unit at the end of its anticipated life cycle. So long as the fire department maintains a fully outfitted, heavy rescue truck at one of the stations, the duplication of vehicle and equipment assets is a drain on the maintenance and vehicle replacement budgets.*

### **5.33 Truck 6 Recommendations:**

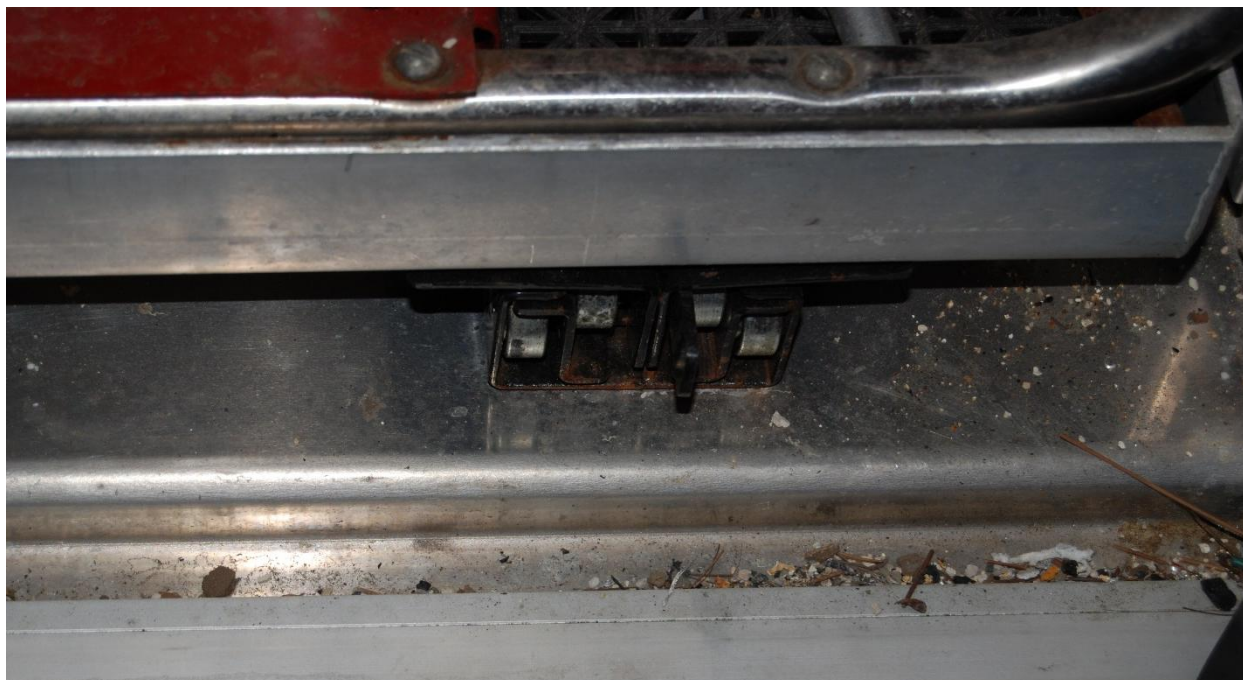
*The following items are recommended to be implemented on the rescue truck to improve the safety and operational characteristics of this apparatus:*

- 1. All tools and equipment carried inside of the body compartments including forcible entry tools, extinguishers, gas powered saws and appliances should be mounted and secured. The interior compartments are being damaged due to the unrestrained equipment carried on the apparatus.*
- 2. The chassis air reservoirs should be provided with drain valves and stainless steel cables extended to the side of the body to permit personnel to drain the air system on a regular basis without having to climb under the apparatus.*
- 3. The chassis frame rails, radiator and components should be periodically steam cleaned to remove surface rust and corrosion from this area.*
- 4. All interior compartments and floors should be cleaned of dirt and debris. The door gasket rubber on all of the side and rear body roll up doors should be replaced to reduce the infiltration of dirt and road debris into body compartments.*





**Image 5.34 Loose fire extinguishers in right body compartment on Truck 6**



**Image 5.35 Minor rust on steel slide tray and debris at right front compartment on Truck 6**

**5.36 Tanker 1:**

## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*Tanker 1 is a former United States Air Force jet refueler built on a 1975 Dodge 800 tandem axle chassis. The elliptical tank was installed during 1986 by the Liberty oil Equipment Company and has a capacity of 5000 gallons. This tank was designed with interior baffles to transport various grades of jet fuel and was modified with a rear dump valve and refill system to act as a water tanker. Due to the difference in weight between jet fuel and water the vehicle currently carries approximately 4200 gallon of water, with a chassis gross vehicle weight rating (GVWR) of 58,000 pounds.*

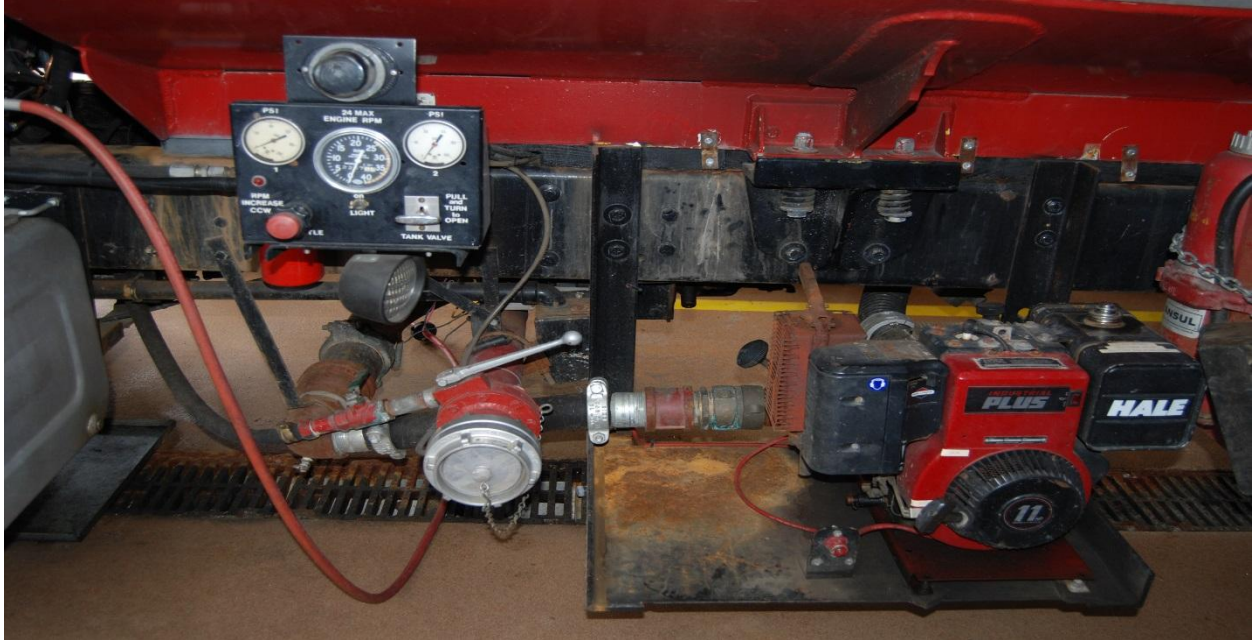
*The tanker is equipped with a 500 gpm pump that was retrofitted to the chassis along with a small complement of 2.50 inch hose that is held in place with seat belts over the left side tandem axle. A 2500 gallon portable tank is carried on top of the tank and would require personnel to climb onto this area to deploy the tank at the scene of an emergency. Several donut rolls of hose are carried inside of the cab behind the fold down seat as the vehicle has very limited compartment storage. The left side underframe box is held closed by a bungee cord and none of the cab access steps meet the National Fire Protection Association Standards that have been in effect since January, 1991.*

*The current in service weight of Tanker 1 is 59,760 pounds, without personnel making this vehicle dangerous and unsafe to operate at any speed on the public roadways. While the fire department was concerned about the tankers roadworthiness and the limited number of authorized drives for this unit, the overweight condition was determined on June 29, 2016 when the vehicle in service weight was verified. In addition to the overweight issues, the cab and chassis components are 41 years old, the vehicle lacks any approved steps, handrails, vehicle stability systems, anti-lock braking systems, warning lights and fire pump instrumentation among other areas.*

*Due to the age, condition and safety issues with Tanker 1, Emergency Vehicle Response recommends that this unit be taken out of service immediately, as this information was discussed with Assistant Chief Steve Charest upon conclusion of the field inspection work in the Town.*

*The Grafton Fire Department, based upon the current condition of the engine company fleet, along with the tanker that is needed to provide water supply for the built upon areas of the Town that are not serviced by either water district requires a combination engine/tanker apparatus which should be assigned to Station One. When the new engine/tanker is placed into service both Engine 4 and Engine 10 as previously described should be removed from service and declared surplus. The self-contained breathing apparatus and some of the hose and nozzles carried on these vehicles can be used to equip the new vehicle, which will require additional appliances and equipment to fully outfit this vehicle. Specific recommendations for the design features and equipment components for this vehicle are detailed in Section 8.1 of this report.*





**Image 5.37 Portable pump mounting and controls on Tanker 1**



**Image 5.38 Right side step access on Tanker 1**

### **5.39 Forestry 1:**

**EMERGENCY VEHICLE RESPONSE FIRE  
PROTECTION SERVICES**

## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*Forestry 1 is one of three wildland vehicles operated by the department and is a 1975 American General 6X6 chassis, model 35A2 that was originally a US Army model 530B structural pumper that was equipped with a 400 gallon water tank. This unit is on loan to the department through the United States Forest Service and currently is equipped with a 500 gpm pump, 1000 gallon steel water tank and an assortment of wildland and brush fire equipment.*

*The apparatus is built with an overall length of 24 feet with a front axle rating of 5988 pounds and rear axle rating of 17,042 pounds. Without any personnel in the cab the unit weights 5680 pound on the front axle and 20,100 pounds on the rear axle. When operating with two personnel in the cab the front axle would be at its rated capacity with the rear axle being 3058 pounds overweight, due to size of the water tank and the equipment carried. Unfortunately there is little that can be done to reduce the vehicle weight by three thousand pounds without significantly reducing the capabilities of the vehicle.*

*As the original body configuration was modified for use as a brush/wildland vehicle, additional aluminum tread plate compartments, increased water tank size, portable pump and other equipment was added all of which has led to the unit being overweight. Due to the age of the chassis, none of the step surfaces, handrails, reflective stripping, warning lights and other safety components were designed into this vehicle. The overweight condition alone is serious and as a result due to the age, condition and safety issues with Forestry 1, Emergency Vehicle Response recommends that this unit be taken out of service immediately, as this information was discussed with Assistant Chief Steve Charest upon conclusion of EVR's field work.*

*Over the past four years the fire department has responded to an average of 16 brush fires each year. While there is a significant amount of land area that is forested and would likely never be developed, the limited number of wildland incidents does not in and of itself justify the expenditure for a new vehicle for these incidents. Emergency Vehicle Response recommends that the Grafton Fire Department turn back in to the appropriate agency both Forestry 1 and Forestry 3 and acquire through government surplus a newer, 1990-1995 vintage 6X6 chassis that could be converted into a heavy duty, wildland unit using an integrated brush fire skid unit with water and foam tanks, along with sufficient aluminum compartments to outfit the vehicle.*

*Particular attention should be made to insure that the in-service weight of the vehicle, once fully equipped with hose, tools, equipment and full tanks of diesel, water and foam that the unit is within the chassis GVWR with a sufficient margin to permit future expansion. The completed apparatus should comply with National Fire Protection Association 1906, Standard for Wildland Apparatus and be up fitted to meet the needs of the Grafton Fire Department.*



## TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW



Image 5.40 Body and water tank on Forestry One



Image 5.41 Example of a National Guard surplus 6X6 chassis modified for use as a forestry unit

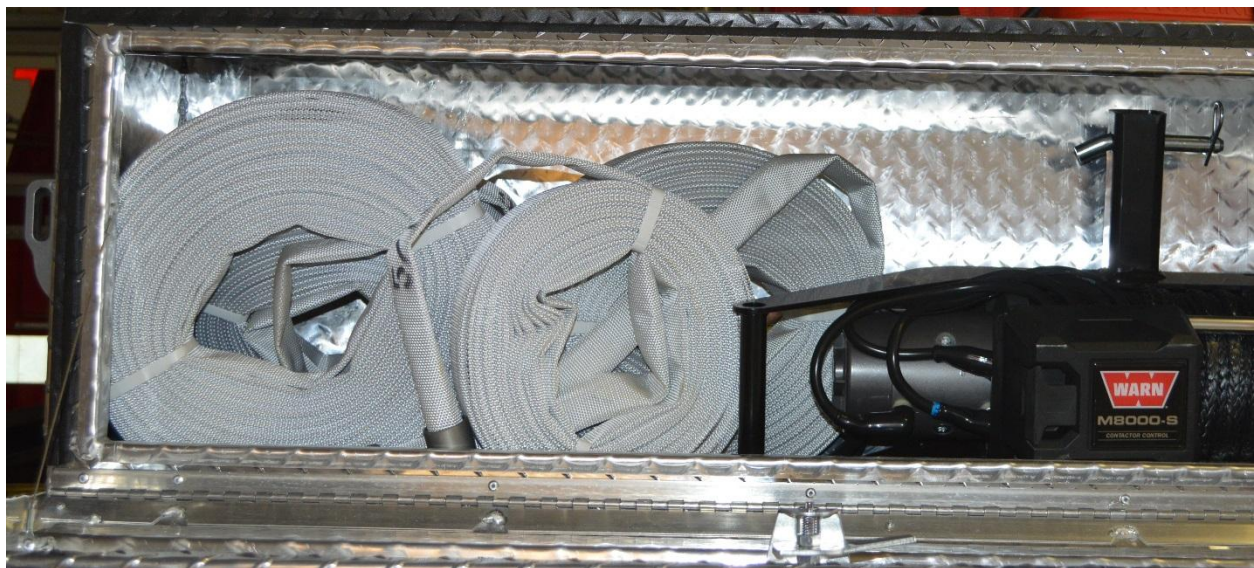


## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

### **5.42 Forestry 2:**

*Forestry 2 is a 2016 Ford F-350 four wheel drive pickup body equipped with a brush fire skid outfitted by MHQ Municipal. The unit is equipped with a CET 125 gpm pump and a UPF 150 gallon water tank. A Class A Scotty foam system is supported by a five gallon tank. The vehicle is built with a wheelbase of 156.00 inches with a gross vehicle weight rating of 11,300 pounds. The four door cab is capable of seating four personnel and has an in-service weight of 9710 pounds. This vehicle responds as the second due wildland unit from the station and is equipped with top mounted booster reel, hand tools, portable winch and a single crosslay hose tray. This brush/wildland unit cost approximately \$75,000 dollars including hose and equipment. Should the fire department require a brush vehicle for assignment to Station 2, a unit similar to Forestry 2 should be provided to replace Engine 10. Recommendations to improve the safety and operation for Forestry 2 are as follows:*

- 1. The chassis frame rails and rear underbody should be steam cleaned with all exposed rust, dirt and debris removed. The chassis steam cleaning should be conducted on at least an annual basis and after a significant off-road incident to remove accumulated dirt, road debris and surface rust from the chassis and other components.*
- 2. The nozzles, fittings and adapters carried in the left side aluminum tread plate compartment and under the brush fire skid unit should be mounted and secured with NFPA 1901 compliant 9G rated brackets.*
- 3. The forestry hose carried in the right side aluminum tread plate compartment should be carried in a protected hose tray on the exterior of the body as shown.*



## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

### **5.43 Forestry 3:**

*Forestry 3 was out of service at the time of the field survey due to chassis brake issues. This vehicle is a 1966 American General 6X6 chassis, model 35A that is on loan to the department through the United States Forest Service and currently is equipped with a 300 gpm pump, 600 gallon UPF water tank and an assortment of wildland and brush fire equipment.*

*The apparatus is built with an overall length of 22 feet, 9 inches and could not be moved from the fire station to verify the in-service weight. The vehicle is outfitted with a Waterous engine driven fire pump and a locally installed UPF poly water tank. The support system for the water tank appears to be home built and not in accordance with the manufacturers engineering requirements. The exterior body and compartments are fabricated of steel treadplate and while rugged in appearance could contribute to a potentially overweight vehicle, similar to Forestry 1.*

*This vehicle is the oldest unit in the Grafton Fire Department fleet, with a chassis that is 50 years old. Due to the age of this unit, it is suspected that any repair parts for the braking system and other components will be difficult and costly to acquire. Similar to Forestry One, this unit lacks non-slip step surfaces, handrails, reflective stripping, warning lights and other safety equipment, including carrying bolt cutters loose on the floor of the cab.*

*Emergency Vehicle Response recommends that the Grafton Fire Department turn back in to the appropriate agency both Forestry 1 and Forestry 3 and acquire through government surplus a single, newer 6X6 chassis that could be converted into a heavy duty, wildland unit using an integrated brush fire skid unit with water and foam tanks, along with sufficient aluminum compartments to outfit the vehicle. The location and staffing of this one heavy forestry vehicle can be determined by the chief officers and should be acquired after the acquisition of the new engine/tanker for Station One.*

### **5.44 Utility M-2:**

*The fire department operates this one support unit which was acquired from the Town of Grafton Sewer Department. This vehicles is a 2002 Chevrolet 3500 two door cab with a Knapheide utility body. The vehicle has 76,090 miles and carries a 6500 watt Honda generator, several portable and telescopic lights, axes, fire extinguishers, water rescue gear and forcible entry tools. The vehicle has a chassis GVWR of 12,000 pounds and has an in-service weight of 8475 pounds without personnel. The use of this vehicle is generally relegated to support long term incidents, exterior lighting and personnel transport. The department's fire bureau currently utilizes Forestry 2 for transportation to inspections and other field work. The replacement for M-2 should be based upon the department's actual utilization for this vehicle and if needed, a four door cab, four wheel drive pickup chassis may provide a better platform for this unit.*

*Recommendations to improve the safety and operational capabilities for M 2 are as follows:*

## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

- 1. The cab and body should be provided with Scotchlite reflective stripping on both sides and the rear of the vehicle in accordance with the minimum requirements of NFPA 1901 as this unit would be utilized as an emergency vehicle.*
- 2. The axes, Little Giant ladder, shovel and water fire extinguisher and forcible entry tools carried on the exterior of the body and rear bed should be mounted and secured with NFPA 1901 compliant 9G rated brackets. Loose equipment carried inside of the body compartments should be properly mounted and secured to protect the lighting equipment and fire extinguishers from damage.*
- 3. The Paratech brand halligan tool carried above the left side body compartment should be removed from service and replaced with a drop forged, single piece halligan tool similar to a Fire Hooks Unlimited Pro Bar.*



**Image 5.45 Equipment storage in rear body of M-2**

### **6.0 Apparatus and Equipment Maintenance Evaluation:**



## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*The fire department maintenance program is overseen by the Assistant Chief of each respective station with the assistance of the department officers and members who together are responsible for the coordination of repairs and maintenance on the apparatus fleet. Apparatus maintenance checks are conducted by department personnel on a regular basis after each incident using check off style forms. Each piece of apparatus is subject to annual preventative maintenance conducted by the outside vendors. During the past few years due to the size of the fleet several apparatus have not been completely maintained in accordance with NFPA 1911 with several units requiring corrosion repairs and many requiring new tires.*

*Annual pumper service tests have not been conducted by an outside fire apparatus repair service as well as on aerial/tower ladder, partially due to extensive repairs to Engine 4, Engine 10 and the foam system on Engine 1. The ground ladders carried on the engines and tower do not have current certifications. The overall condition of the fleet is fair at best with many vehicles in need of corrosion repairs and the overweight conditions on Tanker 1 and Forestry 1. From a pragmatic viewpoint after review of the available maintenance records and vendor invoices much of the repair work completed on the apparatus fleet has been reactive rather than a proactive, preventative maintenance program. The fire department has annually budgeted approximately \$41,000 dollars for apparatus parts and labor which is not adequate to provide the necessary and required testing, maintenance and certifications on a fleet of thirteen units.*

*This condition is not the fault of any one individual; but rather indicative of an aging vehicle fleet that is largely made up of poorly designed apparatus that has not held up to the duty cycle and environmental conditions. With the exception of Engine 2 and Rescue 1 each front line apparatus is in need of immediate attention and in some cases such as Engine's 4 and 10 the cost of safety and mechanical repairs exceed the re-sale value of the apparatus. Unfortunately, several of the departments in service units were constructed by manufacturers that are no longer in business and cannot support warranties and specialized parts.*

*With this in mind the Emergency Vehicle Response recommendations for new apparatus will emphasize a back to basics approach to provide the needed apparatus while incorporating proven technology to minimize the rust and corrosion issues that have surfaced on the current units. The department's current fleet needs to be cared for and maintained if they are to provide the necessary front line service without having to prematurely replace more than one apparatus at any one point in time. With the modest number of annual fire incidents along with the increased use of road de-icing chemicals the department must address the corrosion issues and the remaining older vehicles in order to be able to provide at least twenty years of reliable front line service.*

### **6.1 Apparatus Maintenance Recommendations:**

## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*Each piece of apparatus is generally well outfitted with tools and equipment to perform the needed functions at incidents, although very few pieces of equipment are mounted and secured. Equipment that is not restrained and mounted inside of the cab with appropriated 9G rated brackets are dangerous and should not be permitted. Following are recommendations that should be adopted and implemented by the fire department to insure the safe condition and readiness of all apparatus.*

- 1. All apparatus preventative maintenance and records should be conducted in accordance with National Fire Protection Association Standard 1911 with complete records kept on all repairs, testing and maintenance work. A hard copy log book should be provided for each piece of apparatus where all maintenance, testing and inspection work will be documented. An annual summary of the cost of repairs and all maintenance should be completed by the department to enable tracking of all related repairs and cost of ownership.*
- 2. Each piece of apparatus including engines, tower, forestry and support units should be weighed annually on each axle, together with the total vehicle weight in accordance with NFPA 1911 with the vehicle weight posted inside of the apparatus cab.*
- 3. Each piece of apparatus should at least annually be removed from service to have the chassis frame rails steam cleaned, minor paint and corrosion issues repaired, all tools and equipment cleaned, painted and maintained in conjunction with any required outside vendor repairs and preventative maintenance work to insure continued reliable front line service.*
- 4. The fire department should incorporate a periodic inspection of the underside of the apparatus including the chassis frame, fire pump and associated vehicle components. The electrically controlled valves on the tower should be exercised periodically to insure their safe and proper operation under all conditions.*
- 5. The fire department should engage the services of Underwriter's Laboratories to conduct annual certification testing for the tower ladder. Any deficiencies noted should be repaired within the required time frame to insure the vehicles safe operation. The certification label should be prominently displayed in a location adjacent to the turntable controls*
- 6. All future apparatus specifications should require finish painted chassis frame rails, cross members and components to minimize the impact of road deicing chemicals. Where possible, any steel components that can be treated with a plating process to reduce rust and corrosion in these areas or using stainless steel components where available will help insure the safe and reliable front line service of the apparatus.*
- 7. All fire hose should continue to be tested annually in accordance with NFPA 1962. Records should be kept on these tests and all repairs completed on each length of hose.*

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8. *All ground ladders on the engines and tower should continue to be inspected and tested annually in accordance with NFPA 1932. Complete records should be maintained by the fire department on all tests and repairs that are conducted by the department or an outside vendor on the ground ladders.*
9. *All apparatus equipped with a major fire pump should be service tested annually with complete records maintained on these tests. Any deficiencies noted during this testing should be repaired and corrected by a trained and certified mechanic.*
10. *All tools and equipment particularly forcible entry tools that are carried inside of the cab should be properly mounted and secured with NFPA 1901 required 9G certified brackets and hardware to secure the equipment in place in the event of vehicle accidents or roll over. Several units have improperly stored equipment in the cab including metal clip boards, step ladders, Pelican boxes, milk crates with water, SCBA cylinders and bolt cutters which are not restrained.*
11. *Each apparatus when removed from service for preventative maintenance work should have the compartments and hose beds thoroughly cleaned. All new apparatus, prior to being placed into front line service should have all tools and equipment mounted by the manufacturer.*
12. *Future apparatus new vehicle purchases should consider having extended warranties supplied with the vehicle including a minimum of a three year bumper to bumper warranty, extended warranties for the fire pump and a minimum of a seven year non-prorated cab and body paint warranty. These upfront costs will shift some of the responsibility for routine repairs and warranty coverage from the Town to the original manufacturer.*
13. *Vehicles that are identified in the report as requiring new tires to replace ones that in some instances are in excess of fifteen years old, or original to the date of the vehicle purchase should be replaced on a regular schedule and integrated into the departments overall replacement cycle, similar to protective turnout gear, hose and other major equipment. Replacement tires may be acquired through the Massachusetts State Contract or procured from local heavy truck tire vendors. For a typical apparatus requiring six (6) new tires the cost may range from \$3500 to \$4000 dollars per vehicle.*
14. *Any used vehicles that is being considered by the department for use as a brush/wildland unit should be thoroughly inspected with a review of the past repair and maintenance history to verify the actual condition of the truck and its suitability for continued service as an emergency vehicle.*

### **7.0 Equipment Review:**

*From an overall perspective the engines, tower, rescue and other special service units are well equipped and supplied with an assortment of hand, power and hydraulic tools for use at most fire and rescue*

## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*related incidents. Rescue 1 has most all tools and equipment mounted or arranged in a manner for efficient and safe operation. Other units, including the three engines, tower and forestry units have not made good utilization of the available compartment space with few piece of equipment mounted and secured including saws, rescue tools and appliances. Following is a listing of some equipment that may be worthwhile to consider in the future:*

- 1. All Paratech brand forcible entry tools should be removed from service and sold as scrap. These tools are dangerous as the adz and fork ends are press fitted onto the shaft and held in place with a set pin. These tools should be replaced with a single piece, drop forged Halligan tool similar to a Fire Hooks Unlimited Pro-Bar.*
- 2. All automatic hand line fog nozzles should be tested and inspected to insure that the proper flow rating and pressure is being achieved with the fire department's standard operating procedures.*
- 3. Each engine apparatus should be equipped with 250 feet of 3.00 inch hose and a lightweight gated wye or water thief for use as a leader line to extend the 200 foot attack lines and for use with a portable ground monitor.*
- 4. Smooth bore tips together with a stream shaper should be provided on all master stream appliances and the platform monitors to provide effective stream reach and penetration when operating master streams.*
- 5. The department should provide a minimum of a 28 foot, two section extension ladder, 14 to 16 foot roof ladder, 10 foot folding ladder and 13-17 foot Little Giant style ladder on all future engine apparatus to enhance the ground ladder capabilities of the department when operating at multi-story structures.*
- 6. The equipment weight and payload on each apparatus should be determined at some point, prior to any new, replacement apparatus being acquired. Starting with the engines and moving onto the truck each unit should be stripped of all hose, tools and appliances and then weighed on certified scales. The empty weight of the unit with a full tank of water and all fluids can then be compared to the fully equipped in service weight to accurately determine the equipment payload on each unit. This information will be needed when designing new apparatus to reduce the possibly of operating overweight vehicles.*
- 7. The ladder belts carried at the left, rear of Forestry 1 should be removed from service and not replaced. The presence of these belts would indicate that personnel are permitted to ride and operated on the exterior of this vehicle. No personnel should be permitted to ride, stand or operate on the exterior of any vehicle in the Grafton Fire Department fleet at any time.*





**Image 7.1 Safety belts carried at the rear step on Forestry 1  
No personnel should be permitted to ride on the side or rear of any wildland  
vehicle at any time**

### **8.0 Apparatus Fleet Replacement:**

*Historically the Grafton Fire Department fleet has consisted of three engines, two forestry engines, rescue truck, tanker, light utility truck, three brush/forestry trucks and an aerial device. Due to the geographic size of the first due response areas within the Town of Grafton each station maintained at*

## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*least three vehicles with the central headquarters station responsible for operating the ladder company and tanker. This deployment strategy was partially based upon having sufficient staffing to operate each piece of apparatus. All of the current front line engines, tower and rescue each provide enclosed seating for at least six personnel.*

*Due to the current condition of the apparatus fleet with several overweight units that need to be removed from service and the limited capabilities of Engine 4 and Engine 10, the Grafton apparatus fleet needs to be right sized to provide a reliable fleet of vehicles designed to support the departments mission with a combination of new engine and engine/tanker apparatus, along with repurposed government vehicles for wildland fire fighting.*

*Of equal concern is the age and condition of the current fleet with six vehicles in excess of twenty years old and two units, Engine 1 and Tower 1 each 16 and 15 years old respectively. At one point the vehicle acquisitions were nominally spaced out, approximately one new apparatus every three years. Since 2001 only one new engine has been placed into service with the department acquiring a new air/light unit, heavy rescue and Type 6 forestry unit, assigned as Forestry 2 at Station One.*

***As a result of the evaluation of all current apparatus the recommendation of Emergency Vehicle Response is to remove from service the following units: Tanker 1, Forestry 1 and Forestry 2. These units can be immediately declared as surplus and turned back in to the appropriate agency or sold via government auction. Once the new combination engine/tanker is placed into service at Station One, both Engines 4 and 10 should be removed from service and sold via government auction as these units have very low residual value for reuse in another fire department. In the interim, a minimal amount of financial resources should be spent on Engine 4 and Engine 10 until these two pumpers can be removed from service.***

*With the addition of an engine/tanker unit to the fleet, this apparatus should be deployed as the first due unit within Station One's response district, permitting Engine 1 to be placed into second line, reserve status. Engine 1 has been the most expensive vehicle in the fleet to maintain with a lengthy list of additional repairs that are currently required. The objective here is to maintain this apparatus in a safe and reasonable condition until the engine is slated for replacement in 2023. The overall maintenance and repair costs for this unit should be carefully monitored on a regular basis with the hope that by placing the engine into second line status repair and maintenance costs can be reduced to a nominal level and permit the apparatus to provide an additional seven years of service.*

*The lack of a dedicated capital equipment replacement program, combined with the original design and components used to construct several of the units has created a condition where the current state of the department's apparatus fleet is at a critical stage with several overweight vehicles and older units that require constant maintenance.*

### **8.1 Engine/Tanker Apparatus:**

## **TOWN OF GRAFTON FIRE DEPARTMENT APPARATUS FLEET REVIEW**

*The concept with the new engine/tanker apparatus design is to provide a short wheelbase unit equipped with multiple attack lines of various sizes and lengths along with 4.00 inch supply line hose and a 2500 gallon tank with both side and rear remotely controlled dump valves. The engine/tanker should be equipped with low crosslay hose beds to permit personnel to stretch and advance attack lines with a compliment of engine company equipment and appliances. The first vehicle to be acquired under the proposed fleet replacement program should be placed into service by the end of 2017 and will replace three units, Tanker 1, Engine 4 and Engine 10.*

*The following design criteria should be adopted by the fire department for engine/tanker apparatus:*

- 1. Four door custom cab with seating for six (6) personnel*
- 2. Wheelbase between 210 inches and 225 inches*
- 3. Overall length between 34 and 35 feet*
- 4. Overall height between 126 and 130 inches*
- 5. 500 Horsepower diesel engine with engine brake*
- 6. Five speed automatic transmission*
- 7. Disc brakes, 17 inch on front axle, S-Cam brakes on rear axle*
- 8. 1500 gpm single stage fire pump, side mount pump panel*
- 9. 2500 gallon water tank with poly construction*
- 10. Water tank to have side and rear dump valve controlled from cab*
- 11. Minimum of six (6) preconnected attack lines*
  - a. one (1) 100 foot 1.75" trash line*
  - b. one (1) 150 foot 1.75" attack line*
  - c. one (1) 200 foot 1.75" attack line*
  - d. one (1) 300 foot 2.00" attack line with smooth bore nozzle*
  - e. one (1) 200 foot 2.50" attack line with smooth bore nozzle*
  - f. one (1) 250 foot 3.00" leader line*
- 12. Hose bed to accommodate 1200 feet of 4.00" supply line*
- 13. Hose bed to accommodate 2.50" attack line and 200 feet of 3.00" leader line*
- 14. Apparatus body to be constructed of aluminum or stainless steel with similar subframe*
- 15. Apparatus body to have partial full height compartments on left side with ground ladders on right side of body mounted low*
- 16. Ground ladders to be mounted on right side including a 28 foot extension ladder, 16 foot roof and 10 foot folding ladders, portable water tank to be mounted on left side body*
- 17. Provide for a five scene lights 12 volt powered LED to include a cab brow light, two mid-body and two rear body lights*
- 18. All body compartments to be equipped with appropriate trays, shelves and tool boards with all hand tools mounted inside the compartments in a standard location*
- 19. LED lighting should be utilized for all running and emergency lights*
- 20. 5.00" front suction with power operated valve from pump operators position*

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21. All sides of the apparatus to have high visibility reflective graphics
22. Each unit to have standard department lettering and graphics with unit numbers
23. Full width steel reinforcement channel mounted behind front bumper
24. Drive shaft safety guards on each section of the driveline
25. Six Group 31 batteries on stainless steel trays with minimum of 340 amp Niehoff alternator
26. Back up camera system with both right side and rear cameras
27. Front windshield down view mirror
28. Air operated pump primer
29. Electronic stability control
30. Stainless steel straps on diesel fuel tank and all air reservoirs
31. Stainless steel pull cables for each air reservoir with remote mounted drain valves
32. Stainless steel trays and hardware for the battery boxes
33. IMMI Reach Ready orange color seat belts with extended female stalks
34. Finish painted chassis frame rails, cross member, body sub-frame and components
36. Chassis frame rails, cross members, body sub-frame and components should be treated with any available corrosion treatment as a part of the manufacturing process

*An engine/tanker apparatus as outlined above would cost in the range of \$650,000 to \$700,000 dollars in current day costs and would provide for improved fire flow delivery, enhanced safety for the operating members and would be used for chassis cab and pump panel standardization in the future. The new apparatus should be designed to be as short and maneuverable as possible and should incorporate as many of the above listed bullet points as the basis for the initial design.*

*While a new concept for the Grafton Fire Department to embrace, the engine/tanker provides a multi-faceted unit to provide both engine company service and rural water supply for the community. The smaller vehicle when compared to the size and weight of Tower 1 and the current tanker should permit more department personnel to become trained to operate the apparatus and will enable three, older, overweight and maintenance intensive vehicles to be removed from the fleet. Conceptual examples of the engine/tanker design are shown on the following page for reference.*



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### **8.2 New engine water tower apparatus:**

*The oldest front line engine in the department's fleet is Engine 3, a 1994 Pierce Saber. While this unit is twenty two years old, the engine is in fairly good condition which is a testament to the care given this vehicle by members of the South Grafton station. None the less, this apparatus will need to be replaced and should be the second vehicle acquired under the fleet replacement program in 2020, permitting a three year break in-between the acquisition of the engine tanker in 2017 and Engine 1, planned for 2023. Station 3 is equipped with twelve foot high overhead doors which would allow a slightly higher apparatus to be housed at this location.*

*Due to the number of multi-story residential homes, condominiums, townhomes and apartment buildings throughout the Town of Grafton there is a definite need to provide enhanced ground ladder capabilities along with a 50 to 65 foot elevated master stream device which incorporates an access ladder. These devices are commonly referred to as Tele Squirt or Sky Boom appliances and would permit the department to deploy and operate this apparatus using a standard engine chassis design while enabling the vehicle to carry additional ground ladders with improved maneuverability when compared to the departments tower ladder which has a wheelbase of 270 inches and overall length of just under 46 feet.*

*Similar to the conceptual design of the engine/tanker the replacement for Engine 3 should be as short and maneuverable as practical with a side mount pump panel and multiple attack lines, along with at least 110 feet of portable ground ladders. This unit would be the second vehicle acquired in 2020, permitting the retirement of Engine 3 when this unit would be 26 years old.*

*The following design criteria should be adopted by the fire department for any new engine company units:*

- 1. Four door custom cab with seating for six (6) personnel*
  - 2. Wheelbase between 200 inches and 210 inches*
  - 3. Overall length between 32 feet and 33 feet, 6 inches*
  - 4. Overall height between 135 and 138 inches*
  - 5. 500 Horsepower diesel engine with Jacobs engine brake*
  - 6. Five speed automatic transmission*
  - 7. Disc brakes, 17 inch on front and rear axles*
  - 8. 1500 gpm single stage fire pump with side mount pump controls*
  - 9. 750 gallon low profile water tank with poly construction*
  - 10. 50 foot to 65 foot rear mounted telescopic water tower with access ladder and 1000 gpm rated waterway with remote controlled monitor from rear step area*
- 
- 11. Minimum of six (6) preconnected attack lines*

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- g. one (1) 100 foot 1.75" trash line*
- h. one (1) 150 foot 1.75" attack line*
- i. one (1) 200 foot 1.75" attack line*
- j. one (1) 300 foot 2.00" attack line with smooth bore nozzle*
- k. one (1) 200 foot 2.50" attack line with smooth bore nozzle*
- l. one (1) 250 foot 3.00" leader line*
- 12. Hose bed to accommodate 1000 feet of 4.00" supply line*
- 13. Hose bed to accommodate 2.50" attack line and 200 feet of 3.00" leader line*
- 14. Apparatus body to be constructed of aluminum or stainless steel with similar subframe*
- 15. Apparatus body to have low side compartments on both left and right sides*
- 16. Ground ladder compliment to include a 28 foot extension ladder, 35 foot extension ladder, 14 foot roof and 16 foot roof ladders, 10 foot folding ladder, 13-17 foot Little Giant ladder*
- 17. Provide for a five scene lights 12 volt powered LED to include a cab brow light, two mid-body and two rear body lights*
- 18. All body compartments to be equipped with appropriate trays, shelves and tool boards with all hand tools mounted inside the compartments in a standard location*
- 19. LED lighting should be utilized for all running and emergency lights*
- 20. 5.00" front suction with power operated valve from pump operators position*
- 21. All sides of the apparatus to have high visibility reflective graphics*
- 22. Each unit to have standard department lettering and graphics with unit numbers*
- 23. Full width steel reinforcement channel mounted behind front bumper*
- 24. Drive shaft safety guards on each section of the driveline*
- 25. Six Group 31 batteries on stainless steel trays with minimum of 340 amp Niehoff alternator*
- 26. Back up camera system with both right side and rear cameras*
- 27. Front windshield down view mirror*
- 28. Air operated pump primer*
- 29. Electronic stability control*
- 30. Stainless steel straps on diesel fuel tank and all air reservoirs*
- 31. Stainless steel pull cables for each air reservoir with remote mounted drain valves*
- 32. Stainless steel trays and hardware for the battery boxes*
- 33. IMMI Reach Ready orange color seat belts with extended female stalks*
- 34. Finish painted chassis frame rails, cross member, body sub-frame and components*
- 36. Chassis frame rails, cross members, body sub-frame and components should be treated with any available corrosion treatment as a part of the manufacturing process*

*An engine apparatus as outlined above would cost in the range of \$750,000 to \$800,000 dollars in current day costs and would provide for enhanced engine company service, ground ladder capabilities*



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*and an elevated master stream that can be operated by one person. This water tower apparatus should be designed to be as short and maneuverable as possible and should incorporate as many of the above listed bullet points as the basis for the initial design. A conceptual example of the engine vehicle equipped with a water tower is shown below for reference.*



### **8.3 Fleet Replacement Plan:**

*Due to the serious condition of the departments fleet of thirteen vehicles there is little margin for error as both the tanker and at least one of the heavy forestry units need to be deadlined due to overweight conditions and the mechanical issues with Forestry 3. With only one new engine apparatus placed into service since 2001, there is specific, corrective action that needs to be undertaken to stabilize the remaining vehicles in the fleet. Under this recommendation Tanker 1 would be the first unit replaced in 2017, which would permit Engine 4 at thirty five years old and Engine 10, a twenty seven years old all to be retired and removed from the fleet.*

### **Fleet Replacement and Activity by Year:**



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2016: Remove Tanker 1, Forestry 1 and Forestry 3 from service with all units returned to the appropriate loaning agency

2016: Order a new engine/tanker to replace Tanker 1, **estimated cost of \$650,000-\$700,000**

2017: Acquire a used military chassis for up fitting as wildland unit to replace Forestry 1 and 3, **estimated cost of \$75,000 to \$100,000**

2017: New engine/tanker is outfitted and placed into service, Engine 4 and Engine 10 are removed from service and sold. Engine 1 goes to reserve service at Station One

2019: Order an engine equipped with a water tower to replace Engine 3, **estimated cost of \$850,000 to \$900,000**

2020: New Engine 3 is outfitted and placed into service, current unit is removed from service and sold

2022: Order a new engine to replace Engine 1, **estimated cost of \$725,000 to \$775,000**

2023: New Engine 1 is outfitted and placed into service, current unit is removed from service and sold

2025: Order new aerial device to replace Tower 1, **estimated cost of 1.7 to 1.85 million**

2026: New Truck 1 is outfitted and placed into service, current unit is removed from service and sold

2028: Truck 6: Determine the utilization of this vehicle and consider off line and not replaced

2030: Order new engine to replace Engine 2, **estimated cost of \$925,000 to \$975,000**

2031: New Engine 2 is outfitted and placed into service, current unit is removed from service and sold

2033: Order new heavy rescue, incorporate any equipment needed which would impact overall vehicle size based upon station housing requirements

2034: New heavy rescue is outfitted and placed into service, current unit is removed from the fleet

2036: Replace Forestry 2 with a new Type 6 or appropriate brush/wildland unit

2037: Order new engine/tanker to replace Engine Tanker 4

2038: New Engine/Tanker 4 is outfitted and placed into service, current unit is removed from service  
This replacement schedule provides an average of three years in between each major apparatus acquisition with units averaging between twenty and twenty four years old at their replacement date.

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*Depending upon incident responses, staffing, repair and maintenance costs the life cycle for the engines can be adjusted slightly to provide the optimum service life for each apparatus.*

### ***Fleet Replacement and Activity by Unit:***

*Engine 1: Replace with new engine in 2023, current vehicle would be 23 years old, unit moves to second line status in 2017.*

*Engine 2: Replace with new engine in 2031, current vehicle would be 19 years old.*

*Engine 3: Replace with new engine equipped with a water tower and enhanced ground ladders in 2020, current vehicle would be 24 years old.*

*Engine 4: Offline in 2017 when the new engine tanker is placed into service.*

*Engine 10: Offline in 2017 when the new engine tanker is placed into service.*

*Tanker 1: Offline in 2016 due to overweight age and overweight condition, replace with new engine/tanker in 2017.*

*Tower 1: Replace with new aerial or tower in 2026, current apparatus would be 25 years old.*

*Rescue 1: Replace with new heavy rescue in 2034, current apparatus would be 20 years old.*

*Truck 6: Determine need for replacement in 2028, retire from service and transfer equipment as needed.*

*Forestry 1: Offline in 2016 due to overweight condition, replace with used heavy 6X6 chassis and equip for use as wildland unit in 2017.*

*Forestry 2: Replace with Type 6 vehicle in 2036, current unit would be 20 years old.*

*Forestry 3: Offline in 2016 due to age and condition, combine services with Forestry 1 into a single heavy brush unit for use wildland unit in 2017.*

### ***8.4 Fleet Replacement Summary:***

*The Grafton Fire Department's apparatus fleet is at a critical stage and one that unfortunately cannot be rectified within a short period of time. Several seldom used but important vehicles are seriously*

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*overweight and average 44 years old and when combined with the excessive repair and maintenance costs for Engines 1, 4 and 10 state of fleet readiness is poor at best. Depending upon the ability of the Town of Grafton and the fire department to address these concerns and adopt the fleet replacement cycles as recommended it will take a minimum of four to five years with sufficient financial support and planning to stabilize the fleet.*

*The goal of the fleet replacement plan is to have a defined schedule for new and replacement apparatus supported by available funding. While new apparatus can be acquired, equipped and operated by the officers and members the corrosion and safety issues must be corrected and addressed if the life cycle of the apparatus are to successfully meet the established goals and time frames as outlined. The proposed fleet replacement options and recommendations will assist the Town of Grafton and the fire department to provide apparatus that will meet the current and future needs of the community.*

*The cost estimates for the units planned to be acquired by the Town of Grafton between 2016 and 2030 are based upon current acquisition costs with an average inflation factor of four percent each year. Projecting annual cost increases is somewhat subjective as governmental regulations from the EPA and other regulatory agencies have impacted all heavy truck manufacturers at various times over the past decade. Depending upon the timing of the initiation of these regulations, particularly with respect to diesel engine emissions and green gas technologies, the degree of annual increase can change dramatically.*

*The next round of planned changes to the NFPA 1901-Automotive Fire Apparatus Standard is scheduled to take effect on all units ordered after January 1, 2021. For this reason Emergency Vehicle Response has recommended that the first several units to be replaced would be acquired prior to this date which would strongly enhance the fire departments capabilities while replacing vehicles that are overweight and reaching the end of their practical service life. The overall size of the department's fleet would be reduced, which should have an impact on lowering the repair and maintenance costs as older units are removed from service.*

*Fleet planning and replacement requires a prudent and programmed approach to future fire apparatus and equipment purchases which will be designed to meet the needs of the response area with enhanced maintenance capabilities. While there can always be a desire to replace multiple units at one time there must be a logical approach to the long term capabilities of the vehicle fleet. The recommendations put forth in this report should assist the Grafton Fire Department in meeting that goal.*

### **9.0 Summary:**

*We gratefully acknowledge the cooperation and assistance of Assistant Chief Steve Charest, officers and administrative staff of the Grafton Fire Department who provided information on*



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*the apparatus, response policies and procedures, fire incident responses and other records that were made available for review by the staff of Emergency Vehicle Response.*

*The summary, findings and recommendations as developed in this report are solely those of Emergency Vehicle Response and have not been influenced by any representative of the fire department or any outside parties. The information and statistics cited within the report were gained from fire department records and information supplied for our review.*

*The adoption and implementation of the fleet replacement program along with the recommendations made for each piece of apparatus will advance the safety and reliability of the Grafton Fire Department's fleet. In addition the rural, non-hydrant areas of the response area would see improved fire protection through the inclusion of a reliable, well designed engine/tanker along with additional preconnected attack lines of varying sizes and lengths. The financial resources needed to implement this fleet replacement program would be lessened with the reduction of four vehicles from the current fleet and allow these funds to be diverted to other needed fire protection services. .*

*The staff of Emergency Vehicle Response looks forward to meeting with the Town of Grafton officials, fire department chief officers and other stakeholders to review and discuss the findings and recommendations included in this report.*

*Respectfully submitted,*

*Michael Wilbur*

*Tom W. Shand*